PL-TR-94-2248

DESIGN AND DEVELOPMENT OF A CLOUD REFERENCE LIBRARY AND SUPPORT FOR CLOUD AND SIMULATION COMMUNITIES.

Summary Report

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Science and Technology Corp.
101 Research Drive
Hampton, VA 23666-1340

September 1994

Final Report
September 1989–September 1994

Approved for public release; distribution unlimited

PHILLIPS LABORATORY
Directorate of Geophysics
AIR FORCE MATERIEL COMMAND
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13. ABSTRACT *(Maximum 200 words)*

This report summarizes the work accomplished under Contract No. F19628–89–C–0190. Three primary activities and products resulted from the work: (1) The development, implementation, and updating of the Cloud Information Reference Library and Archive (CIRLA). CIRLA provides information in cloud simulations, models, algorithms, analyses, and databases, and has recently been made accessible via Internet. (2) Three major conferences on Cloud Impacts on DoD Operations and Systems (CIDOS) — CIDOS–89/90, CIDOS–91, and CIDOS–93. The CIDOS conferences have evolved from evaluation by the DoD atmospheric science community of the impacts of clouds on military weapons systems, sensors, and operations, through the inclusion of civilian applications, to DoD simulation activities. (3) A survey of the DoD modeling and simulation (M&S) community's requirements for environmental models and databases. An overall strategy that planned and executed the survey task, including development of a comprehensive Requirements Questionnaire, was presented for Air Force and E^{2}DIS Project approval.

14. SUBJECT TERMS
Air Force, algorithms, analyses, archive, CIDOS, CIRLA, cloud, cloud effects, conference databases, Department of Defense, Distributed Interactive Simulation, DIS, DoD, environmental effects, E^{2}DIS, Internet, library, modeling, modeling and simulation, M&S, models, questionnaire, requirements, Services, simulation, simulators, strategy, survey

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CONTENTS

FOREWORD

Science and Technology Corporation (STC) is pleased to submit this final summary report "Design and Development of a Cloud Reference Library and Support for Cloud and Simulation Communities," by Dr. Paul D. Try of the STC-Washington, DC office, Mr. John Burgeson of the STC-Lexington, Massachusetts office, and Mr. Tom Piwowar and Dr. Paul F. Twitchell of the STC-Washington, DC office. The work was funded under U.S. Air Force Phillips Laboratory Contract No. F19628–89–C–0190. The valuable cooperation and support of Mr. Donald D. Grantham, Laboratory Contract Manager, Phillips Laboratory, during the period of performance of this contract is gratefully acknowledged.

This report summarizes the work accomplished under U.S. Air Force Phillips Laboratory Contract No. F19628–89–C–0190. Three primary activities and products resulted from the work: the development, implementation, and updating of the Cloud Information Reference Library and Archive (CIRLA); three major conferences on Cloud Impacts on DoD Operations and Systems (CIDOS), CIDOS–89/90, CIDOS–91, and CIDOS–93; and a survey of the DOD modeling and simulation (M&S) community's requirements for environmental models and databases.

The concept of CIRLA originated at CIDOS–88, which formally recommended the development of a user-friendly link between the cloud researchers and those who need information on clouds. The consensus at the conference was that the process of development and employment of increasingly sophisticated weapon systems, many of which rely on sensors that are adversely affected by clouds, could be improved with a better way for systems analysts and engineers to gain knowledge of and access to complete cloud information.

The initial implementation of CIRLA was completed in 1990. The basic objective was and is to provide an easily accessible, rapid communication between those in the research community who develop cloud information in any form and those who need that information. Hence, CIRLA is an online database whose entries are posted on electronic bulletin boards. STC developed the CIRLA database by preparing entries from more than 100 responses to questionnaires, sent to those who attended CIDOS–89/90 and to others with an interest in the study of clouds.

CIRLA describes the information (on cloud simulations, models, algorithms, analyses, and databases), its format, how it can be obtained and applied, and its status. Each entry provides sufficient detail for users to determine if the available information (for example, on a database, model, or code) suits their purpose. The objective of CIRLA is to provide a rapid, user-friendly communication between users of cloud information and its providers. CIRLA is readily accessible to anyone with a personal computer (PC) and a modem, or through Internet.

The original database design (a database of databases) has not required modification. Data are placed into one or more of five categories: models and simulations, databases, algorithms, summaries, and reference information. Each of these is divided into cloud databases (low, middle, high, stratospheric and noctilucent, structures, cloud-free line-of-sight or other), meteorological databases (temperature, water vapor, precipitation, liquid water content, visibility, optical depth, microphysics, or other), or other. In addition, there are databases of recent additions, notices, meetings, and comments to CIRLA.

Other unique entries were added to the CIRLA database in 1991 and 1992, but by 1992 the original widespread interest in CIRLA was difficult to sustain. Some users were concerned that the information may have become outdated, while others could not conven-iently access CIRLA because they did not have a PC with a modem to use the electronic bulletin board. STC responded by arranging for CIRLA to be accessible through Internet. In addition, STC concluded that CIRLA needed revitalization.

In early 1993 STC launched a major campaign to update the entries in CIRLA and expand their information content. Anyone who contributed more than one CIRLA entry was contacted by telephone or telefax. Those who contributed a single entry to CIRLA received a letter and then follow-up telephone calls if necessary to ensure contact. STC sent to all contributors copies of their entries, a reminder of what CIRLA is, instructions for logging on, an explanation of the update process, and a request for new cloud information and for comments about CIRLA.

Altogether, 66 letters, 64 faxes, and more than 100 long distance telephone calls were required to solicit new or updated information for CIRLA. Most contributors made no or only minor changes (38), but there are 11 new and 16 substantially modified entries. On the other hand, 14 entries were deleted because their contributors could not be contacted, 11 were deleted because their contributors ignored several opportunities to update, and 8 were deleted at the request of the contributors. Before the update CIRLA had 124 entries (previously provided to the COTR); when the update was complete CIRLA had 103 entries. The following is an example of a CIRLA entry.

Listing:	LOWTRAN/MODTRAN/FASCODE
Title:	LOWTRAN/MODTRAN/FASCODE Cloud Models
Description:	Models the radiative properties of clouds within the LOWTRAN, MODTRAN, and FASCODE atmospheric transmission/radiance models. The cloud models include cumulus, stratus, stratocumulus, nimbo-stratus, altostratus, and cirrus clouds (standard, subvisual, and the NOAA cirrus model from LOWTRAN 6). The radiative properties include the attenuation coefficients and asymmetry parameters as a function of wavelength from the UV through the microwave regions (wavelengths longer than 0.2 μm).
Format:	Fortran code.
Access:	Models are distributed by the National Climatic Data Center (NCDC) in Asheville, NC.
Application:	Basic research and theoretical investigations.

Status: Operational

CIRLA Updated: 2/24/93 Phone Number: (617) 377-2337

POC Name: Ms. Gail Anderson

Address: Phillips Laboratory, PL/GPOS, Hanscom AFB MA 01731-5000.

Co-Contributor: E. P. Shettle and V. J. Falcone

Remarks: For further information, reference "Models of Aerosols, Clouds, and Precipitation for Atmospheric Propagation Studies," E.P. Shettle (1989), in "Atmospheric Propagation in the UV, Visible, IR & MM-Wave Region and Related System Aspects," AGARD Conference Proceedings No. 454, Proceedings of the AGARD Electromagnetic Wave Propagation Panel Symposium, Copenhagen, Denmark, 9–13 October 1989.

The following is a list of CIRLA titles, showing what is available in the updated CIRLA.

"CLOUD" Model (A Stratiform Cloud Infrared Scene Generator)

3-Dimensional Cloud Model

3-Dimensional Predictive Eulerian Grid Point Model

Atlas of Simultaneous Occurrence of Different Cloud Types Over Land.

Atlas of Simultaneous Occurrence of Different Cloud Types Over the Ocean.

Analysis Data Bases—Minor: 500-mb Vorticity, Boundary Layer Windows, Precipitable Water, and Upper Air Windows

Analysis Data Base: 3DNEPH (3-Dimensional Nephanalysis)

Analysis Data Base: 3DNEPH–LMHT/A (Low, Middle, High Type/Amount)

Analysis Data Bases: Coarse Mesh Upper Air, Eighth Mesh Surface Temperature, and HIRAS (High Resolution Analysis System)

Analysis Data Base: RTNEPH–LMHT/A (Low, Middle, High Type/Amount)

Analysis Data Base: RTNEPH–Real Time Nephanalysis

Archived NOAA Climatological Data

Attenuation Data of the XM-81 Smoke Grenade at 35 and 95 GHz

CFLOS/CFARC/Hole-Boring Models

CIRRUS Software (Cloud Image Representation, Recognition, and Understanding Software)

Ceiling/Visibility Observation and Forecast Simulation Model (CVOF)

Cirrus Clouds, Some Properties and Effects on Optical Systems

Climatological Probability of Cloud-Free Line-of-Sight (CPCFLOS)

Climatology from Surface Observations of Clouds Over the Globe

Climatology of Cloud Statistics (C Clouds S)

Cloud Analysis Metric Software (CLAMS) Program

Cloud Data from Nimbus-7 Satellite Observations

Cloud Data in Support of Blue-Green Modelling Work for Optical Communications

Cloud Database (Derived From 5 Years of RTNEPH Data)

Cloud Imagery on Selected Bands

Cloud Scene Generator Model (CLDGEN)

Cloud and Longwave Radiation Relationships

Cloud-Free Arc Simulation Model

Cloudiness and Percentage of Possible Sunshine

Clouds and Background Data From FISTA Aircraft

Coincident DMSP Data

Computer Model for Ice Water Content and Particle Size Distribution

Daedalus Thermatic Mapper Simulator (TMS) Data on Clouds

Data Collected from Optical Telescopes in Southwest

Detection of Clouds and Cloud Shadows in Multispectral Image Sets

Diagnostic Calculation of Clouds Based on Humidity Within NOGAPS 3.3 Prediction

Directory of Climatic Databases

Dual Polarization Ruby Lidar Measurements of Middle and High Clouds

Extinction and Backscatter Coefficient Profile Model (RKOPF)

Finite Cloud Computer Model

First ISLSCP (International Satellite Land Surface Climatology Project) Field Experiment

Frequency of Occurrence Contours of Cloud States for Europe

Future Shuttle Flights

GOES/VAS Satellite Observations of Cloud Cover Over the CONUS Using the CO_2 Global Distribution

Global Distribution of Total Cloud Cover and Cloud Type Over the Ocean

High Altitude (85 km) Ice Clouds (Polar Mesospheric Clouds)

IRAMMP Data Base of IR Scene Radiances

Imaging IR Data in Various Bands at Varying Altitudes

Informational Data Base: Master Station Catalog (at USAFETAC/OL-A)

Informational Data Base: Terrain-Geography File (at USAFETAC/OL-A)

Infrared Data Obtained from Highly Calibrated Airborne Measurements Program

International Satellite Cloud Climatology Project (ISCCP) Monthly Products

LOWTRAN/MODTRAN/FASCODE Cloud Models

Laser-Cloud Interaction Model

MODIS Airborne Simulator (MAS) and Cloud Absorption Radiometer (CAR) Measurement

Microwave Scattering Properties of Spheroidal Ice Hydrometeors (Graupel) and Ice

Model to Separate Direct and Diffuse Components of Ground-level Solar Irradiance

Modeled Ceiling and Visibility (MODCV) Climatology

Multiple Scattering Model for Cloud Spectral Reflectance

Multispectral Cloud Data

NASA ER-2 MODIS-N Data

NOAA/HIRS Cloud Observations Globally Using Carbon Dioxide Slicing

Near IR Extinction and Backscatter Versus Distance

Nimbus-7 Cloud Data Sets

Observational Data Bases–Minor: DATSAV Aircraft, Rocketsonde, and Satellite

Observational Data Bases: DATSAV Upper-Air, DATSAV2 Surface, and Space Environmental Support System (SESS)

Observational Data Bases: TDF-13 Foreign Surface, TDF-14 Airways METAR, TDF-34 Summary of the Day, TDF-35 West Germany Summary, TDF-52 Foreign PIBAL, TDF-53 Worldwide Winds Aloft, TDF-54 Worldwide Radiosonde, TDF-56 Worldwide Radiosonde, and TDF-57 Worldwide RECCO (Dropsonde)

One-Dimensional Steady State Cloud Model (1DSS)

Selective Guide to Climatic Data Sources

Simulation and Visualization of Clouds

Spectral Solar Radiation Data Base

The Greenhouse Effect Detection Experiment (GEDEX)

The International Station Meteorological Climate Summary (ISMCS)

The TASC/PL Cloud Scene Simulation Model (CSSM)

Thermal Images of Cumulus and Cirrus Clouds

Vertical and Horizontal Measurements Within, Above, and Below Maritime Stratus

Visible and Long Wave IR Satellite Video Imagery From the Delta Star Satellite

Water Vapor, Precipitation, Clouds, and Fog

Whole Sky Imager (WSI) Data

In the early 1980s the DoD cloud impacts community organized what evolved into CIDOS for the purpose of encouraging interaction among researchers from industry, academia, and defense organizations. STC made all arrangements (held initial tri-service planning meetings to set the concept, agenda, and location for the CIDOS conferences, activated a Call for Papers, prepared initial plans for arranging the conference, and organized and ran the meetings) for formal CIDOS conferences and focused their purpose such that the cloud community became a resource for defense-related problems and issues of greater scope and magnitude. Proceedings and workshop reports were assembled, published, and distributed to the attendees following each of the conferences. Agendas of the three conferences are contained in Appendix A.

The primary purpose of CIDOS–89/90 was to evaluate, through atmospheric sciences, the impacts of clouds on weapon systems, sensors, and military operations. The focus of CIDOS–91 was applications, specifically the implications of clouds in various DoD and civilian areas of interest. CIDOS–93, the most recent conference, focused on simulation and applications of cloud models and databases to acknowledge the increasing DoD interest in modeling and simulation as well as the importance of accounting for environmental effects, especially clouds. At CIDOS–91 STC presented a paper on the development of the new computer-based online CIRLA, and at CIDOS–93 a poster paper on the updated CIRLA and how it could be accessed.

The third and what was the primary activity for the final year of this contract was work on Task 5 of the Environmental Effects on Distributed Interactive Simulation (E^2DIS) project. For this task STC organized the activities leading to the determination of the major environmental simulation requirements (current and anticipated) of the U.S. Air Force, Army, Navy, and Marine Corps involving weapon systems operating in the environment that includes the near-earth atmosphere (excluding terrain and oceans), ionosphere, magnetosphere, and near-space. The objective of the requirements survey is to define the required simulation environments and provide the basis for the selection of the natural environment, environmental effects, and environment process models for incorporation into E^2DIS.

STC took a systematic, top-down approach to conducting the requirements survey. A few months after Dr. Paul Try presented STC's capabilities of performing the survey, Mr. Tom Piwowar briefed STC's plans for conducting the survey to the Environmental Survey Team (EST), which included representatives throughout the Phillips Laboratory Geophysics Directorate and from the U.S. Army Research Laboratory/Battlefield Environment Directorate and the Naval Research Laboratory–Monterey. The survey strategy was based on identifying all major modeling and simulation efforts within the Services, determining appropriate points of contact (POCs) for these efforts, and sending them a well-designed, comprehensive environmental requirements questionnaire.

All four services headquarters modeling and simulation (M&S) key POCs were visited and briefed on the E^2DIS project in general and the environmental requirements survey in particular. These briefings marked the beginning of STC's approach to the survey. In-person visits were conducted starting at the headquarters levels and moving down to lower management levels where most of the major M&S efforts are taking place, to identify these efforts and who is leading them. From these visits and other coordination activities, STC prepared a list of major service M&S activities and their POCs.

STC developed the Requirements Survey Questionnaire and integrated several sets of comments and recommendations that were received from the members of the EST. In addition, the questionnaire was thoroughly β-tested to ensure that it would accomplish its purpose. After coordination and testing of the questionnaire was completed, copies of the final version were sent to the appropriate POCs, who were required to answer all questions carefully. Appendix B contains the final version of the questionnaire, and Appendix C contains the letters indicating the service distribution process.

Using *Paradox for Windows* version 4.5, STC designed and developed a relational database consisting of 24 normalized tables to organize the information collected on the Requirements Survey Questionnaire. The database was designed to facilitate querying and reporting of related information and preparation of a comprehensive Environmental Simulation Requirements document. At the end of the reporting period, several questionnaires had been entered into the database to complete this pilot effort.

APPENDIX A

CONFERENCE AGENDAS

APPENDIX A -I

CLOUD IMPACTS ON DOD OPERATIONS AND SYSTEMS 1989/90 CONFERENCE (CIDOS 89/90)

Naval Postgraduate School
Ingersoll Hall
Monterey, California

9-11 January 1990

AGENDA

TUESDAY, 9 JANUARY 1990

0800 - 0900 **REGISTRATION**
Ingersoll Hall, Naval Postgraduate School

0900 - 1000 INTRODUCTORY SESSION

Conference Chairperson
Mr. Donald D. Grantham, Atmospheric Sciences Division, Geophysics Laboratory

Welcome
Professor Robert Bourke, Associate Dean for Faculty and Graduate Studies, Naval Postgraduate School

Sponsor's Address
Colonel Ted S. Cress, U.S. Air Force, Military Assistant for Environmental Science, Office of the Under Secretary of Defense for Acquisitions

Keynote Address
Cloud Issues in the Smart Weapons Operability Enhancement Program
Dr. Lewis E. Link, Jr., Technical Director, U.S. Army Cold Regions Research and Engineering Laboratory

1000 - 1030 **COFFEE BREAK**

1030 - 1230 SESSION I - CLOUD IMPACTS STUDIES

Chairperson
Lt Col Kenneth E. Eis, U.S. Air Force, 2nd Weather Squadron, HQ Air Weather Service

ORAL PRESENTATIONS

Implications of Cloud Obscuration on Ground Based Laser Systems for Strategic Defense
Kathryn M. Parker, Michael T. Tavis and Scott W. Levinson, Air Force Space Systems Division

Impact of Icing on UAV Operations
Richard A. Siquig, Naval Oceanographic and Atmospheric Research Laboratory

The Oceanic Cloudy Atmosphere: Measurement Requirements and Solution Options
Richard Siquig and **Duncan B. Ross**[1], Naval Oceanographic and Atmospheric Research Laboratory and [1]Martin Marietta Corporation

Cloud Impact On Ascot System Performance
Edward M. Tomlinson and Stanley H. Grigsby[1], METSAT, Inc. and [1]PRA, Inc.

The Use of SAGE II and RTNEPH Data to Compute CFLOS for Air-to-Air EO Surveillance
Amnon Dalcher, Institute for Defense Analyses

Nuclear Particulate Cloud Environments
Charles R. Gallaway and Thomas A. Mazzola[1], Defense Nuclear Agency and [1]R&D Associates

RELEVANT POSTER PRESENTATIONS/DEMONSTRATIONS

Optical Depths Over A Target Area Immediately Following A Massive Nuclear Strike
Michael M. Bradley, Kendall R. Peterson, Paul H. Gudiksen, and Daniel J. Rodriquez, Lawrence Livermore National Laboratory

1230 - 1330 **LUNCH BREAK**

1330 - 1550 **SESSION II - CLOUD DETECTION AND CATEGORIZATION**

Chairperson
Dr. Andreas K. Goroch, Naval Oceanographic and Atmospheric Research Laboratory

ORAL PRESENTATIONS

Interannual Variability in Cloud Frequency as Determined from GOES Satellite
Donald L. Reinke, Cynthia L. Combs, Edward M. Tomlinson, and Thomas H. Vonder Haar, METSAT, Inc.

Cloud Classification of DMSP Visible and Infrared Imagery Using Textural Features and Microwave Radiometer Imagery
Andreas K. Goroch and R. M. Welch[1], Naval Oceanographic and Atmospheric Research Laboratory and [1]Institute of Atmospheric Science, South Dakota School of Mines and Technology

A Summary of the Physical Properties of Cirrus Clouds
David R. Dowling and Lawrence F. Radke, Boeing Aerospace and Electronics

Multispectral Cloud Property Retrieval Exploiting Radiative Transfer Theory
Ronald G. Isaacs, B. Lee Lindner, and Ross N. Hoffman, Atmospheric and Environmental Research, Inc.

1445 - 1515 **COFFEE BREAK**

Cirrus Cloud Cover From GOES and NOAA Satellites
Donald P. Wylie, Edwin Eloranta, and Christian Grund, University of Wisconsin/Madison

Target Area Cloud Field Characterization Using Unmanned Air Vehicles
Michael J. Kraus, Geophysics Laboratory

RELEVANT POSTER PRESENTATIONS/DEMONSTRATIONS

Automated Cloud Typing From Satellite
Rupert Hawkins and Robert d'Entremont, Geophysics Laboratory

Technique for Cloud Discrimination on GOES Infrared Imagery
Cynthia L. Combs, Donald L. Reinke, Edward M. Tomlinson, and Thomas H. Vonder Haar, METSAT,Inc.

Automated Visibility & Cloud Cover Measurements with a Solid-State Imaging System
J.E. Shields, M.E. Karr and T.L. Koehler, Scripps Institution of Oceanography, University of California, San Diego

1550 - 1730 **SESSION III - CLOUD DATABASES, ARCHIVES AND CLIMATOLOGIES**

Chairperson
Dr. J. William Snow, Atmospheric Sciences Division, Geophysics Laboratory

ORAL PRESENTATIONS

Cloud Information Reference Library and Archive
Steven S. Painter, Science and Technology Corporation

A Technique for Developing a GMS Based Cirrus Cloud Climatology
Clement J. Thomas and Karen E. Penoza, Boeing Aerospace and Electronics

A High Resolution Cloud/No-Cloud Database
Ernest R. Talpey, The Analytic Sciences Corporation

A Climatic Cloud Atlas For North America
John R. Hanzis and Arthur E. O'Brien, MITRE Corporation

New Algorithms for the Climatology of Cloud Scenes
Albert Boehm, James Willand, and Julia Steeves, ST Systems Corporation

RELEVANT POSTER PRESENTATIONS/DEMONSTRATIONS

The Cloud Data Base within the NRL Backgrounds Data Center
Lothar H. Ruhnke, Naval Research Laboratory

1800 - 2100 **POSTER PRESENTATIONS/DEMONSTRATIONS AND ICEBREAKER**
Pebble Beach Room, Hyatt Regency Monterey

WEDNESDAY, 10, JANUARY 1990

0730 - 0800 REGISTRATION
Ingersoll Hall, Naval Postgraduate School

0800 - 1000 **SESSION IV - CLOUD ANALYSIS AND PREDICTION**

Chairperson
LCDR Janice P. Garner, U.S. Navy, Strategic Defense Initiative Organization, Directed Energy Directorate

ORAL PRESENTATIONS

The Whole Sky Imager Network and Some Emerging Comparative Data
Richard W. Johnson, T. L. Koehler, and J. E. Shields, University of California/San Diego

Cloud-Free Line-of-Sight (CFLOS) Assessments Using High Space and Time Resolution Satellite Data
Thomas H. Vonder Haar, Chi-Fan Shih, Edward M. Tomlinson, and Donald L. Reinke, METSAT, Inc.

Incidence Angle Effects In Cloud Cover Observed With Delta Star
David L. Glackin, The Aerospace Corporation

Near Real-Time Cloud Analysis for the Forecaster Workstation Environment
Carlyle H. Wash, Naval Postgraduate School

Development of Numerical Weather Prediction Techniques for Operational Forecasting of Cloud Impacts on Reentry Tests
Mark. L. Bradford, Aeromet, Inc.

Cloud Forecast Model Development at the Air Force Global Weather Central
Capt James R. Schaefer and Capt Thomas M. Hamill, Air Force Global Weather Central

RELEVANT POSTER PRESENTATIONS/DEMONSTRATIONS

Persistence Forecasts From High-Resolution Cloud Composite Climatologies
Donald L. Reinke, Cynthia L. Combs, Edward M. Tomlinson, and Thomas H. Vonder Haar, METSAT, Inc.

1000 - 1030 COFFEE BREAK

1030 - 1230 SESSION V - CLOUD MODELING AND SIMULATIONS

Chairperson
Lt Col George G. Koenig, U.S. Air Force, Optical Physics Division, Geophysics Laboratory

ORAL PRESENTATIONS

Finite Cloud-Laser Pulse Interaction Modeling
John Yen, Naval Ocean Systems Center

Cloud Modeling Requirements of Pulsed Laser Communications Systems
Alan R. King, Naval Ocean Systems Center

Inter-Level CFLOS/CFFOV Simulation Model
Capt James T. Kroll, U.S. Air Force Environmental Technical Applications Center

Preliminary Data Requirements Analysis For CFLOS4D/CFARC Model Validation
Steven R. Finch and Kenneth B. MacNichol, The Analytic Sciences Corporation

A Modeling Investigation of the 28 October 1986 FIRE Cirrus Case
William R. Cotton, Melville E. Nicholls, Piotr J. Flatau, and Lt Scott Hockman, Colorado State University

Tailoring Cloud Statistics For Simulators
Kenneth Moe, Space Systems Division/WE(AFSC)

RELEVANT POSTER PRESENTATIONS/DEMONSTRATIONS

Adaptation of a Non-Hydrostatic Model to Forecast Cloud Elements and Cloud Ensembles For Reentry and Launch Operations
Mark L. Bradford and Dan J. Rusk, Aeromet, Inc.

Forecasting Mesoscale Cloud Impacts on Weapons Tests with the Mesoscale Atmospheric Simulation System (MASS)
Mark L. Bradford, Aeromet, Inc.

Cluster Analysis of Wind Profiles
John E. Cockayne and Harvey A. Singer, Science Applications International Corporation

The SAIC Dynamic Visibility Model
David L. Levine and C. Robert Wieser, Science Applications International Corporation

1230 - 1330 LUNCH BREAK

1330 - 1530 SESSION VI - CLOUDS AS BACKGROUND/CLUTTER

Chairperson
Dr. Frank E. Niles, Director, Atmospheric Effects Division, U.S. Army Atmospheric Sciences Laboratory

ORAL PRESENTATIONS

Calculating Solar and Infrared Radiation Fields for BTI/SWOE
John R. Hummel and David A. Hazen, SPARTA, Inc.

Cloud Background Radiance in the Short-Wave Infrared
Lewis L. Smith, Grumman Corporate Research Center

Simulation of Background Cloud Images for Sensor System Design and Evaluation
Frederick C. Mertz and David C. Anding, Photon Research Associates

Earth Scene Effects on AOA Dedicated Target Penaid Signatures
Kent E. Eversmeyer and Ellen S. Montenegro, Teledyne Brown Engineering

1445 - 1500 COFFEE BREAK

A Comparison of Predicted Cloud Radiance and Measured Data in the Infrared
Chris Blasband and James Jafolla, Photon Research Associates

A Comparison of Satellite Derived Radiances With Airborne Radiometer Measurements
Vanessa L. Griffin and Michael J. Newchurch, Teledyne Brown Engineering

RELEVANT POSTER PRESENTATIONS/DEMONSTRATIONS

Analysis of Radiometric Knees Using Lowtran 6
Michael J. Newchurch and Eric O. Schmidt, Teledyne Brown Engineering

1530 - 1730 SESSION VII - LIDAR MEASUREMENTS OF CLOUDS

Chairperson
Dr. William A. Hoppel, Space Sciences Division, Naval Research Laboratory

ORAL PRESENTATIONS

University of Wisconsin Lidar Observations of Cirrus Clouds, Part 1: Overview and Highlights
Edwin W. Eloranta and Christian J. Grund, University of Wisconsin

Lidar Measurement of Thin Cirrus and Clear Air Background
T. D. Wilkerson, A. Notari, U. N. Singh, and B. Bloomer, University of Maryland

Aerosol and Cloud Lidar Backscatter Profiles in the Equatorial South Atlantic
Lt Col George G. Koenig, Eric P. Shettle, Steven B. Alejandro, and J. Michael Vaughan[1], Geophysics Laboratory and [1]Royal Signals and Radar Establishment

Polar Mesospheric Clouds and Their Impacts on Ultraviolet Sensors
Gary E. Thomas, Norman Marsted[1], George Lawrence, Eric Jensen, and Neal Brown, University of Colorado and [1]Boeing Aerospace

Observation of Noctilucent Clouds Using Backscatter Lidar
John W. Meriwether, Phan D. Dao, Ross T. McNutt, Warren P. Moskowitz[1], and Gilbert Davidson[1], Geophysics Laboratory and [1]PhotoMetrics, Inc.

Airborne Lidar/Radiometric Observations of High-Altitude Particulate Distributions
Edward E. Uthe and William D. Kriese[1], SRI International and [1]Boeing Aerospace and Electronics Co.

RELEVANT POSTER PRESENTATIONS/DEMONSTRATIONS

University of Wisconsin Lidar Observations of Cirrus Clouds, Part 2: Details
Christian J. Grund and Edwin W. Eloranta, Univeristy of Wisconsin

1800 - 1900 POSTER PRESENTATIONS/DEMONSTRATIONS
Pebble Beach Room, Hyatt Regency Monterey

THURSDAY, 11 JANUARY 1990

0700 - 0730 REGISTRATION
Ingersoll Hall, Naval Postgraduate School

0730 - 1015 SESSION VIII - LASER/CLOUD INTERACTIONS

Chairperson
Dr. Duane D. Smith, Optical Physics Division, The Aerospace Corporation

ORAL PRESENTATIONS

Single Water Droplet Behavior During Laser Induced Evaporation
Richard P. Welle, The Aerospace Corporation

Cloud Clearing With Long Pulse Infrared Chemical Lasers
G.P. Quigley, R.B. Webster, and G.W. York, Los Alamos National Laboratory

Droplet Shattering, Vaporization, and Recondensation In Laser Irradiated Clouds
Joe M. Kindel, E. J. Caramana, R. L. Morse, G. P. Quigley, R. B. Webster, and G. W. York, Los Alamos National Laboratory

Optical Quality of a Channel Cleared in a Water Cloud by a High Energy CO_2 Laser: Turbulent Mixing and Recondensation
Shirish M. Chitanvis, Los Alamos National Laboratory

Effects of Thin and Subvisible Cirrus on HEL Far Field Intensity Calculations At Various Wavelengths
Larrene K. Harada, W. J. Schafer Associates, Inc.

Cloud Clearing With A CO_2 Laser in a Cirrus Cloud Simulation Facility
Alan P. Waggoner, Lawrence F. Radke[1], Victor R. Buonadonna, Michael F. Weisbach, and David R. Dowling[1], Boeing Aerospace and Electronics, [1]University of Washington

Laser-Induced Spatio-Temporal Index of Refraction Fluctuations In Laboratory Water Clouds
Duane D. Smith, S. M. Beck, and J. A. Gelbwachs, The Aerospace Corporation

1015 - 1100 COFFEE BREAK

1100 - 1230 WORKSHOP SESSIONS
BIG SUR I, II, III, Hyatt Regency Monterey

1230 - 1330 LUNCH BREAK

1330 - 1500 PLENARY SESSION
REGENCY IV, V, VI, Hyatt Regency Monterey

1515 - 1630 EXECUTIVE SESSION
REGENCY IV, V, VI, Hyatt Regency Monterey

1630 END OF CONFERENCE

APPENDIX A-II
Agenda

CLOUD IMPACTS ON DOD OPERATIONS AND SYSTEMS 1991 CONFERENCE (CIDOS-91)

The Aerospace Corporation
Building A1, Room 1062
El Segundo, California
9-12 July 1991

Theme

CLOUDS: THE FIRST ORDER IMPACT–FOR DEFENSE AND CLIMATE CHANGE APPLICATIONS

AGENDA

TUESDAY, 9 JULY 1991

0730 - 0830 **REGISTRATION**
The Aerospace Corporation, Building A1, Room 1062

0830 - 1000 SESSION I: INTRODUCTION AND PROGRAM REVIEWS
Chairperson: **COL Grant C. Aufderhaar**, Military Assistant for Environmental Sciences, Deputy Defense Research and Engineering, Research and Advance Technology, Environmental and Life Sciences

Conference Chairman
Donald D. Grantham, Geophysics Directorate, Phillips Laboratory, Air Force Systems Command

Welcome by Host
Discussion of DOD Assets for Environmental Monitoring
Joseph Straus, The Aerospace Corporation

Sponsor Introductory Address
COL Grant C. Aufderhaar, Military Assistant for Environmental Sciences, Deputy Defense Research and Engineering, Research and Advance Technology, Environmental and Life Sciences

Keynote Address
Cloud Forecasting: The Challenge During Operation Desert Storm
LT COL Gerald Riley, 3WS/CC, Air Weather Service

1000 - 1030 **COFFEE BREAK**

1030 - 1200 **PROGRAM REVIEWS**

Army
Robert Rubio, U.S. Army Atmospheric Sciences Laboratory

Navy

CAPT Herbert P. Colomb, Jr., Assistant Chief of Staff for Operations, Naval Oceanography Command

Air Force

J. William Snow, Geophysics Directorate, Phillips Laboratory

Strategic Defense Initiative Office–Cloud Impacts on GBL

Donald D. Grantham, Geophysics Directorate, Phillips Laboratory

Defense Meteorological Satellite Program

COL John A. Goyette, Defense Meteorological Satellite Program SPO Director

1200 - 1330 **LUNCH BREAK (DMSP & Aerospace Tours)**

1330 - 1415 **Keynote Address**

Analysis of Cloud Observations From Weather Satellites for the International Satellite Cloud Climatology Project

Dr. William B. Rossow, NASA Goddard Institute for Space Studies, Director ISCCP

1415 - 1715 **SESSION II: DATABASES (DOD-CIVILIAN TRANSFER AND APPLICATIONS EMPHASIS)**

Chairperson: **Dr. Gerald Geernaert**, Office of Naval Research

1500 - 1530 **COFFEE BREAK**

ORAL PRESENTATIONS

Cloud Information Reference Library and Archive (CIRLA)

Paul D. Try, and Donald D. Grantham[1], Science and Technology Corporation and [1]Geophysics Directorate, Phillips Laboratory

A Global Environmental Database System

Roland E. Nagle, Computer Sciences Corporation

Cloud Base, Top, and Thickness Climatology From RAOB and Surface Data

CAPT Kirk D. Poore, U.S. Air Force Environmental Technical Application Center

Global Coverage and Seasonal Changes in Cirrus Clouds

Donald Wylie and W. Paul Menzel[1], University of Wisconsin-Madison and [1]NOAA/NESDIS Satellite Applications Laboratory

RTNEPH Total Cloud Cover Validation Study

CAPT Ronald P. Lowther, Mark T. Surmeier, CAPT Richard W. Hartman, Charles R. Coffin, and **CAPT Anthony J. Warren**, U.S. Air Force Environmental Technical Applications Center

Status of the Whole Sky Imager Network Database

Richard W. Johnson, **Thomas L. Koehler**, and Janet E. Shields, University of California, San Diego

Spiral Cloud Identification Using Hough Transforms

Sailes K. Sengupta, Andreas K. Goroch[1], and **Rabindra Palikonda**, Naval Oceanographic and Atmospheric Research Facility and [1]Naval Oceanographic and Atmospheric Research Laboratory

Poster Session II – 2 minute overview by authors

Poster Session V – 2 minute overview by authors

1800 - 1930 **ICEBREAKER – POSTERS FOR SESSIONS II AND V**
El Segundo and Hawthorne Rooms, Ramada Inn

POSTERS FOR SESSION II: DATABASES (DOD-CIVILIAN TRANSFER AND APPLICATIONS EMPHASIS)

Demo of Cloud Information Reference Library and Archive (CIRLA)
Paul D. Try, and Donald D. Grantham[1], Science and Technology Corporation and [1]Geophysics Directorate, Phillips Laboratory

Database of Coincident Lidar and Satellite Observations of Thin Cirrus Clouds
M. Paz Ramos-Johnson and R. Gary Rasmussen, The Analytic Sciences Corporation

Cumulative Frequency of Skycover Below Selected Altitude Levels In Various Climatic Regions
Oskar Essenwanger, University of Alabama in Huntsville

July Climatology of Marine Stratocumulus Clouds
Patrick Minnis, David F. Young[1], and **David R. Doelling**[1], NASA Langley Research Center and [1]Lockheed Engineering and Sciences Corporation

Lidar Observations of Tropical Cirrus Clouds Revisited–Applications of a Proposed Kwajalein Lidar Facility
Edward E. Uthe, SRI International

Rayleigh and Raman Lidar Measurements in Greenland
J. Meriwether, P. Dao, R. Farley, LT R. McNutt, **Gilbert Davidson**[1], and W. Moskowitz[1], Geophysics Directorate, Phillips Laboratory and [1]PhotoMetrics, Inc.

POSTERS FOR SESSION V: CLOUD DETECTION, RETRIEVAL, AND DISPLAY TECHNIQUES

The Three-Dimensional Spatial Structure of Cirrus Clouds Determined From Lidar and Satellite Observations
Edwin W. Eloranta, Donald W. Wylie, and W. Wolf, University of Wisconsin-Madison

Multispectral Imagery on the Satellite Data Handling System for AFGWC Support to Desert Shield/Desert Storm
Earl S. Barker, **Bruce H. Brooks**, and Bruce H. Thomas, Harris Corporation/Aerospace Corporation

Retrieving Atmospheric Temperature Profiles From Simulated DSMP Sounder Data With A Neural Network
Charles T. Butler, R. Van Meredith, and Ari Rosenberg[1], Physical Sciences Inc. and [1]McDonnell Douglas Electronic Systems Co.

Multispectral Aircraft Data and the Snow/Cloud Discrimination Problem
Michael Brandley, Richard DeJulio, Robert Drake, **Steven Westerman**, and Steven Yool, Lockheed Missiles & Space Company

A New Instrument For Water Vapor Sounding: SSM/T-2
Vincent J. Falcone and Michael K. Griffin, Geophysics Directorate, Phillips Laboratory

A New Water Vapor Attenuation Correction for the Air Force Global Weather Central RTNEPH (Real-Time Nephanalysis)
Thomas M. Hamill and CAPT Norman H. Mandy[1], Atmospheric and Environmental Research, Inc. and [1]Air Force Global Weather Central

WEDNESDAY, 10 JULY 1991

0800 - 0830 **REGISTRATION**
The Aerospace Corporation, Building A1, Room 1062

0830 - 1200 **SESSION III: SYSTEMS AND SENSORS (Ground, Airborne, and Satellite)**
Chairperson: **MAJ Frank P. Kelly**, Defense Meteorological Satellite Program SPO, Space Systems Division

0945 - 1015 **COFFEE BREAK**

ORAL PRESENTATIONS

Tactical Nephanalysis (TACNEPH) Program Overview
Ronald G. Isaacs and Gary B. Gustafson, Atmospheric and Environmental Research, Inc.

Tactical Satellite Signatures from Desert Storm Using NOAA Multispectral Data
Thomas F. Lee, Naval Oceanographic and Atmospheric Research Laboratory

Using Clouds to Track Surface Ships
Richard Siquig, Arunas Kuciauskas, and Nahid Khazenie[1], Naval Oceanographic and Atmospheric Research Laboratory and [1]University of Texas

Cloud Remote Sensing Requirements for DMSP Block 6
David L. Glackin and **MAJ Frank P. Kelly**[1], The Aerospace Corporation and [1]AWS-DMSP Liason Office

NWP Impact of Cloud Top and Boundary Layer Winds From a Satellite Borne Lidar: An Observing System Simulation Experiment
Ronald G. Isaacs, C. Grassotti, M. Mickelson, R.N. Hoffman, J.-F. Louis, and T. Nehrkorn, Atmospheric and Environmental Research, Inc.

Imaging Systems for Automated 24-Hour Whole Sky Cloud Assessment and Visibility Determination
Janet E. Shields, Richard W. Johnson, and Thomas L. Koehler, University of California, San Diego

The Impact of Clouds on a Time-Dependent Ground-to-Space Viewing System: A Cloud-Free and Cloudy Arc Analysis
Gary J. Thompson and Vance A. Hedin, Logicon/RDA

Smoke Plumes From Kuwaiti Oil Fires as Atmospheric Experiment of Opportunity
Ernest Bauer, Institute for Defense Analyses

Poster Session III – 2 minute overview by authors

1200 - 1330 **LUNCH BREAK (DMSP and AEROSPACE Tours)**

1330 - 1715 **SESSION IV A: MODELS, SIMULATIONS, AND APPLICATIONS**
Chairperson: **LT COL Roger C. Whiton**, Environmental Technical Applications Center

1500 - 1530 **COFFEE BREAK**

NOTE: Session IV B will be on Thursday, 11 July 1991

ORAL PRESENTATIONS

Operational Forecasting with a 3-D Cloud Model at Kwajalein Atoll
Dan Rusk and Mark Bradford, Aeromet, Inc.

Spectral-Spatial-Temporal Cloud Physics
John Malick, FSI Inc.

Specular Scattering From Cirrus Clouds: A First-Order Model
Joe Shanks, Fred Mertz, Chris Blasband, Tom Kassal[1], Photon Research Associates, Inc. and [1]Grumman Aerospace Corporation

Cloud Scene Simulation Modeling
Maureen E. Cianciolo and R. Gary Rasmussen, The Analytic Sciences Corporation

CFLOS4D Accuracy Assessment Using Whole Sky Imager Data
Kenneth B. MacNichol and **Steven R. Finch**, The Analytic Sciences Corporation

Infrared Radiances from Structured Clouds
E.P. Shettle, R.G. Priest, and I.B. Schwartz, Naval Research Laboratory

Remote Sensing of Cirrus Cloud Parameters From Satellite Data
S.C. Ou, K.N. Liou, and W.M. Gooch, Liou and Associates

Poster Session IV – 2 minute overview by authors

1800 - 1930 **ICEBREAKER – POSTERS FOR SESSIONS III AND IV**
El Segundo and Hawthorne Rooms, Ramada Inn

POSTERS FOR SESSION III: SYSTEMS AND SENSORS (Ground, Airborne, and Satellite)

Use of a Learjet 36 for Cloud and Weather Characterization
Ray Harris-Hobbs and Michael Bellmore, Aeromet, Inc.

Assessment of Cloud Effects on High Altitude Observatory (HALO) Aircraft Operations
Paul Weckler and Dana Swift, Aeromet, Inc.

Whole Sky Cloud Imagery Under Both Day and Night Illumination Levels
Richard W. Johnson, Jack R. Varah, and Eugene M. Zawadzki, University of California, San Diego

Cloud Remote Sensing Concepts With Millimeter Wave Radar
David L. Glackin and **Gregory G. Pihos**, The Aerospace Corporation

Site Specific Cloud Field Analysis In Support of the Department of Energy Atmospheric Radiation Measurement (DOE/ARM) Program
Ronald G. Isaacs, D. Johnson, and W.-C. Wang[1], Atmospheric and Environmental Research, Inc. and [1]Atmospheric Sciences Research Center

Integrated Oceanographic Tactical Aid (AID)
Andreas K. Goroch, **Michael J. Pastore**, and Larry Miller[1], Naval Oceanographic and Atmospheric Research Laboratory and [1]Planning Systems, Inc.

Battlefield Obscuration From the Kuwait Smoke Plume
E.H. Holt, R.A. Sutherland, D.W. Hoock, Dorothy Bruce, John Grace, **S.A. Luces**[1], W.D. Ohmstada[2], and R.A. Pielke[3], and R.L. Walko[3], U.S. Army Atmospheric Sciences Laboratory, [1]Physical Science Laboratory, New Mexico State University, [2]Certified Consulting Meteorologist, [3]Colorado State University

Thermal Infrared Spectroscopy of Natural and Artificial Clouds
David K. Lynch, John A. Hackwell, Ray W. Russell, and Mark A. Chatelain, The Aerospace Corporation

POSTERS FOR SESSION IV: MODELS, SIMULATIONS, AND APPLICATIONS

A Numerical Model for the Prediction of Hydrometeors in the Tactical Environment
Roland E. Nagle, Computer Sciences Corporation

A Massively Parallel Implementation of the MASS Model for Operational Use
Robert Sladewski and **Mark Bradford**, Aeromet, Inc.

Statistics of IR Cloud Changes–A Modelling Approach
Lawrence R. Thebaud, Morton S. Farber, Stewart J. Hemple, and Jerry Tessendorf, Arete Associates

Visual Translucent Algorithm (VISTA)
Albert R. Boehm, ST Systems Corporation

Validation of a Cloud Scene Simulation Model Using AVHRR Multi-Spectral Imagery
Fred Mertz, **Chris Blasband**, Leif Hendricks, Rob Francis, and Dave Anding, Photon Research Associates, Inc.

Simulation of Whole-Sky Imager From Satellite for Cloud-Free Arc Estimates From Space
Donald L. Reinke and Thomas H. Vonder Haar, METSAT, Inc.

Tropical Storm Cloud Analysis Using SSM/I Imagery
Morton Glass and Gerald W. Felde, Geophysics Directorate, Phillips Laboratory

THURSDAY, 11 JULY 1991

0800 - 0830 **REGISTRATION**
The Aerospace Corporation, Building A1, Room 1062

0830 - 0930 **SESSION IV B: MODELS, SIMULATIONS, AND APPLICATIONS**
Chairperson: **LT COL Roger C. Whiton**, Environmental Technical Applications Center

ORAL PRESENTATIONS

Cirrus Clouds in Infrared Targeting Models–A Statement of Modeling and Experimental Needs
R.C. Vik, W.T. Kreiss, Edward E. Uthe[1], W.M. Cornette[2], J.G. Shanks[2], and W.A. Lanich[3], Horizons Technology, Inc., [1]SRI International, [2]Photon Research Associates, Inc., and [3]Wright Laboratories

SSMI Operational Analysis for Thunderstorms
LT COL Charles R. Holliday and CAPT Keith H. North, Air Force Global Weather Central

Strategic Air Command Contrail Formation Study
CAPT Jeffrey L. Peters, Third Weather Wing

0930 - 1230 **SESSION V: CLOUD DETECTION, RETRIEVAL, AND DISPLAY TECHNIQUES**
Chairperson: **Dr. J. William Snow**, Geophysics Directorate, Phillips Laboratory, USAF Systems Command

1005 - 1030 **COFFEE BREAK**

ORAL PRESENTATIONS

TACNEPH Single Channel and Multispectral Cloud Algorithm Development
Gary B. Gustafson, Jean-Luc Moncet, Ronald G. Isaacs, Robert P. d'Entremont[1], James T. Bunting[1], and Michael K. Griffin[1], Atmospheric and Environmental Research, Inc. and [1]Geophysics Directorate, Phillips Laboratory

Cloud Type Identification and Classification Using Spatial Statistical Texture Measures
Nahid Khazenie and Kim A. Richardson, Naval Oceanographic and Atmospheric Research Laboratory

The Three-Dimensional Spatial Structure of Cirrus Clouds Determined From Lidar and Satellite Observations
Edwin W. Eloranta, Donald W. Wylie, and W. Wolf, University of Wisconsin-Madison

Visible Scattering and Infrared Extinction in Clouds Calculated From Satellite and Lidar Data Comparisons
Donald W. Wylie, Edwin W. Eloranta, and Christian Grund[1], University of Wisconsin-Madison and [1]NOAA Environmental Research Laboratory

Parameterization of Visible and Infrared Window Radiances for Cloud Simulation and Satellite Retrievals
Patrick Minnis, Patrick W. Heck[1], and David F. Young[1], NASA Langley Research Center and [1]Lockheed Engineering and Sciences Corporation

The Positive Identification of Optically Thin, Cirrus Clouds in Nighttime Multispectral Meteorological Satellite Data by Automated Cloud Detection and Typing Algorithms
Keith D. Hutchison, Jerry Mack, Russel McDonald, and Grey Logan, Lockheed Austin Division

Simulated Composite Color Imagery For Real-Time Cloud Analysis
Larry W. Thomason and **Robert P. d'Entremont**[1], NASA Langley Research Center and [1]Geophysics Directorate, Phillips Laboratory

Air Force Global Weather Central's (AFGWC) New Surface Temperature Analysis and Forecast Model (SFCTMP)
James H. Cramer and **Thomas M. Hamill**[1], Air Force Global Weather Central and [1]Atmospheric and Environmental Research, Inc.

Polar Cloud Classification Using AVHRR Imagery: A Neural Network Approach With Bootstrap Validation
Sailes K. Sengupta, R.M. Welch, Andreas K. Goroch[1], Rabindra Palikonda, and N. Rangaraj, Naval Oceanographic and Atmospheric Research Facility and [1]Naval Oceanographic and Atmospheric Research Laboratory

1230 - 1400 **LUNCH BREAK**

1400 - 1530 **SESSION VI: INITIAL INDIVIDUAL WORKSHOP MEETINGS**

Workshop A: User Needs
Chairperson: **Mr. Robert Rubio**

Workshop B: Cloud Data Users Handbook
Chairperson: **Mr. Donald D. Grantham**

Workshop C: Models/Databases
Chairperson: **Dr. Andreas K. Goroch**

1530 - 1600 **COFFEE BREAK**

1600 - 1730 **SESSION VII: FINAL INDIVIDUAL WORKSHOP MEETINGS**

EVENING OPEN

FRIDAY, 12 JULY 1991

0830 - 1000 **SESSION VIII: PLENARY – WORKSHOP RECOMMENDATIONS**
Chairperson: Donald D. Grantham, Geophysics Directorate, Phillips Laboratory

1000 - 1030 **COFFEE BREAK**

1030 - 1200 **SESSION IX: EXECUTIVE SESSION**

1200 **CIDOS-91 ADJOURNS**

APPENDIX A-III

CLOUD IMPACTS ON DOD OPERATIONS AND SYSTEMS 1993 CONFERENCE (CIDOS–93)

U.S. Army Topographic Engineering Center
Casey Building, Fort Belvoir, Virginia
16–19 November 1993

Theme

CLOUDS: THE FIRST ORDER IMPACT–FOR DEFENSE AND CIVIL SIMULATIONS

TUESDAY, 16 NOVEMBER 1993

0800 – 0900 **REGISTRATION**
U.S. Army Topographic Engineering Center, Casey Building

Conference Chair
Donald D. Grantham, Geophysics Directorate, Phillips Laboratory, Air Force Systems Command

SESSION I: INTRODUCTION AND PROGRAM REVIEWS
Chair: **Donald D. Grantham**, Geophysics Directorate,
Phillips Laboratory, Air Force Systems Command

0900 – 1000 Welcome
Richard B. Gomez, Associate Director for Technology,
U.S. Army Topographic Engineering Center

Introductory Address
CAPT Bradley P. Smith, USN, Office Director Defense Research and Engineering

Keynote Address
Lt Col David Bartlett, USMC, Defense Modeling Simulation Office

1000 – 1030 **BREAK**

1030 – 1200 **AGENCY PROGRAM REVIEWS**

Army
Robert Northrup, Project Director, Integrated Meteorological System,
U.S. Army Research Laboratory

Navy
Paul Morsedorf, Naval Oceanographic Command

Air Force
J. William Snow, Geophysics Directorate, Phillips Laboratory

Defense Meteorological Satellite Program
COL John A. Goyette, Defense Meteorological Satellite Program SPO Director

International Civil Cloud Programs
Paul D. Try, Science and Technology Corporation

1200 – 1330 **LUNCH BREAK**

1330 – 1400 Invited Paper
Cloud Simulation with the Local Analysis and Prediction Systems (LAPS)
John McGinley, National Oceanic and Atmospheric Administration

SESSION II A: SIMULATION SUPPORT
Chair: **Michael Shore**, Defense Nuclear Agency

1400 – 1500 **ORAL PRESENTATIONS**

Weather Environment Simulation Technology
Brent Henderson and Bruce C. Montag, Southwest Research Institute

Synthetic Global Cloud Cover Field Generation
Maureen E. Cianciolo and Duane L. Apling, The Analytic Sciences Corporation

Structured Clouds Over Terraqueous Terrain (SCOTT) Synthetic Infrared Background Scene Generation Model
Bernard R. Lichtenstein and Scott L. Tyler, Aerojet Electronic Systems Division

1500 – 1530 **BREAK**

1530 – 1730 Defining the Aerial Targeting Environment
Sandra K. Weaver and **Major James R. Schaefer**, Wright Laboratory Staff Meteorology

Hazard Prediction and Assessment Capability and the Omega System
LTC Mark E. Byers, Defense Nuclear Agency; David P. Bacon, Science Applications International Corporation

A Detailed Comparison of CLDSIM (Cloud Scene Simulation Model) Predictions with CIRRIS–1A Radiometer Data in SWIR and MWIR Spectral Bands
Joe Shanks and Frederick C. Mertz, Photon Research Associates, Incorporated; Richard M. Nadile, Phillips Laboratory; Thomas D. Conley, Institute for Space Research, Boston College

Environmental Effects Distributed Interactive Simulation
Stanley H. Grigsby, Techmatics; Fred Wieland, Naval Research Laboratory

Poster Session II A – 2 minute overview by authors

Poster Session IV – 2 minute overview by authors

WEDNESDAY, 17 NOVEMBER 1993

SESSION II B: ANALYSIS AND APPLICATIONS
Chair: **John Hovermale**, Naval Research Laboratory

0830 – 1000 **ORAL PRESENTATIONS**

Optical Profile Function for Modeling Extinction and Backscatter Coefficients in and Beneath Low Stratus Clouds
Henry Rachele, U.S. Army Research Laboratory; **Neal H. Kilmer**, Physical Science Laboratory, New Mexico State University

Cloud Cover and its Relationship to other Meteorological Factors During a Springtime Midlatitude Cyclone
Chris J. Walcek, State University of New York

A Mesoscale Analysis in Central Florida Using a Satellite/Model Coupled Analysis System
Capt Scot T. Heckman, George D. Modica and Alan E. Lipton, Geophysics Directorate, Phillips Laboratory; presented by **Donald A. Chisholm**, Geophysics Directorate, Phillips Laboratory

PCFLOS (Probability of Cloud–Free Line–of–Sight) Estimates for RAPTOR TALON for Iraq and Korea
Ernest Bauer, Institute for Defense Analyses

Discussion of a New CFLOS Methodology
Kenneth E. Eis, Thomas H. Vonder Haar, John M. Forsythe and Donald L. Reinke, *STC*–METSAT

Clouds and Their Environment
James W. Telford, Desert Research Institute

1000 – 1030 **BREAK**

1030 – 1200 Radiative Characteristics of Ship Tracks at Night
Arunas Kuciauskas, Philip Durkee, Charles Skupniewicz and Kurt Nielsen, Naval Research Laboratory, Naval Postgraduate School

Satellite Cloud Analysis Programs at the Air Force Phillips Laboratory: An Overview – Part 1 Tactical Nephanalysis (TACNEPH)
Gary B. Gustafson and Ronald G. Isaacs, Atmospheric and Environmental Research, Incorporated; Robert P. d'Entremont and J.T. Bunting, Phillips Laboratory, Geophysics Directorate

Validation of TACNEPH Cloud Detection Algorithms
Jeanne M. Sparrow, Gary B. Gustafson and Anthony S. Lisa, Atmospheric and Environmental Research, Incorporated; Robert P. d'Entremont, Phillips Laboratory, Geophysics Directorate

Removal of the AVHRR 3.7 μm Channel Solar Component for Retrieving Daytime Cirrus Parameters
S.C. Ou, N.X. Rao and K.M. Liou, University of Utah

Remote Sounding of Cirrus Cloud Microphysics Using AVHRR Data
K.N. Liou, S.C. Ou, N.X. Rao and Y. Takano, University of Utah

An End–to–End System for Automated Cloud Pattern Analysis from Satellite Imagery
Paul M. Tag, Naval Research Laboratory; James E. Peak, Computer Sciences Corporation

Poster Session II B – 2 minute overview by authors

1200 – 1300 **LUNCH BREAK**

SESSION II C: FORECASTING
Chair: **CDR Jim Etro**, Office of the Oceanographic of Navy (N096)

1300 – 1430 **ORAL PRESENTATIONS**

Improved Contrail Forecasting
Capt Carolyn Vadnais, 1Lt Robert Hauser and **Steven P. Weaver**, 645th Weather Squadron

Tropical Cloud Cover Investigations Diurnal Variations and Persistence Forecast Accuracy
Kenneth B. MacNichol, The Analytic Sciences Corporation; presented by **Duane L. Apling**, The Analytic Sciences Corporation

Diagnosing Cloudiness from Global Numerical Weather Prediction Model Forecasts
Donald C. Norquist, H.S. Muench, Douglas C. Hahn and Donald Aiken, Phillips Laboratory

A Short–Term Cloud Forecast Scheme Using Cross Correlations
Thomas M. Hamill and Thomas Nehrkorn, Atmospheric and Environmental Research, Incorporated; **Kenneth F. Heideman**, Phillips Laboratory

Numerical Weather Prediction for Cloud Free Line–of–Sight Forecasting
Mark L. Bradford, Aeromet, Incorporated

1430 – 1445 **BREAK**

SESSION III: SYSTEMS AND SENSORS
Chair: **Mary Ann Seagraves**, U.S. Army Research Laboratory

1445 – 1730 **ORAL PRESENTATIONS**

Visible/Infrared Optical Depths of Cirrus as seen by Satellite and Scanning Lidar
Donald Wylie, Walt Wolf and Edwin W. Eloranta, University of Wisconsin–Madison

Surface and Atmospheric Parameter Retrievals with the DMSP SSMIS in the Presence of Clouds and Precipitation
William Kreiss and Alex Stogryn; GenCorp/Aerojet Electronic Systems Division; Gene Poe, Naval Research Laboratory; Duc Kieu and Roger Dickey, GenCorp/Aerojet Electronic Systems Division

A Dual Use System for Atmospheric Soundings: Test Results from the Technical Demonstration Mobile Profiler System
James L. Cogan, U.S. Army Research Laboratory; Bob Weber and Melinda Simon, National Oceanic and Atmospheric Administration

Automated Whole Sky Imagers for Continuous Day and Night Cloud Field Assessment
Janet E. Shields, Richard W. Johnson and Monette E. Karr, University of California, San Diego

The Impact of Clouds on Airborne Laser Operations
Larrene K. Harada and Daniel H. Leslie, W.J. Schafer Associates, Incorporated

DMSP Cloud Sensor Upgrades for the 90's and Beyond
Mike Barrett and Denny Ometz, Westinghouse Space Division

Poster Session III – 2 minute overview by authors

1800 – 1930 **ICEBREAKER – POSTERS FOR ALL SESSIONS**
Springfield Hilton Hotel

THURSDAY, 18 NOVEMBER 1993

SESSION IV: DATABASES
Chair: **Major Lauraleen O'Connor**, U.S. Air Force
Environmental Technical Applications Center

0830 – 1000 **ORAL PRESENTATIONS**

Robust Database Management for Virtual–Application Environments
James S. Belfiore, Jr., Atmospheric and Environmental Research, Incorporated

Annual and Inter–Annual Changes in Cloud Cover
Donald Wylie, Space Science and Engineering Center, University of Wisconsin–Madison; W. Paul Menzel, Satellite Application Laboratory, National Oceanic and Atmospheric Administration/NESDIS

Cloud Analysis and Forecasting at Air Force Global Weather Central Under the Cloud Depiction and Forecasting System II
Kevin P. Callahan, Raymond B. Kiess, John M. Lanicci and **Thomas J. Neu**, Air Force Global Weather Central

Satellite Cloud Analysis Programs at the Air Force Phillips Laboratory: An Overview – Part 2 Support of Environmental Requirements for Cloud Analysis and Archive (SERCAA)
Ronald G. Isaacs and Gary B. Gustafson, Atmospheric and Environmental Research, Incorporated; J. William Snow and Robert P. d'Entremont, Phillips Laboratory, Geophysics Directorate

1000 – 1030 **BREAK**

1030 – 1200 Unsupervised Segmentation of Multispectral Cloud Imagery
Piali De and John H. Gruninger, Spectral Sciences, Incorporated; Hugh A. Stoddart, NeuroPhysics Research

Investigations of Shiptracks in Marine Clouds
Philip A. Durkee, Kurt E. Nielsen, Charles Skupniewicz and Arunas Kuciauskas, Naval Postgraduate School

Comparison of the Real Time Nephanalysis (RTNEPH) with the High Resolution Satellite Cloud Climatology (HRSCC)
Donald L. Reinke, Kenneth E. Eis, John M. Forsythe, Cynthia L. Combs and Thomas H. Vonder Haar, *STC*–METSAT

Global Water Vapor and Cloud Liquid Water Analyses
Thomas H. Vonder Haar, Donald L. Reinke, David L. Randel, Graeme L. Stephens, Cynthia L. Combs, Mark A. Ringerud, Ian L. Wittmeyer and Thomas J. Greenwald, *STC*–METSAT

1200 – 1300 **LUNCH BREAK**

SESSION V: WORKSHOP MEETINGS

1300 – 1700 Workshop Introduction/Review of CIDOS–91 Workshops
Donald D. Grantham, Geophysics Directorate, Phillips Laboratory

Workshop A: Simulation Support
CoChairs: **Robert Rubio**, U.S. Army Research Laboratory
Stanley H. Grigsby, Techmatics

Workshop B: Cloud Microphysical Impacts Military Systems Support (e.g., Ship/Aircraft Tracks)
CoChairs: **Gerald L. Geernaert**, Office of Naval Research
LTC John Roadcap, Phillips Laboratory/WE

FRIDAY, 19 NOVEMBER 1993

0830 – 1000	WORKSHOP MEETINGS (cont.)
1000 – 1035	**BREAK**
1030 – 1130	CONFERENCE and WORKSHOP WRAP–UP Workshop Chair Reports
1130–1200	FUNDING AGENCY RESPONSE
1200	**CIDOS–93 ADJOURNS**

Posters for Session II A: SIMULATION SUPPORT

The Boundary Layer Illumination and Radiation Balance Model (BLIRB)
Alan E. Wetmore, U.S. Army Research Laboratory; Andrew Zardecki, Los Alamos Consulting

Visualization of Dynamic Cloud Models Using Fractal Ellipsoids
Geoffrey Y. Gardner, Grumman Data Systems

Modifying Target Acquisition Images for Atmospheric Degradation Effects
David H. Tofsted, U.S. Army Research Laboratory

Cloud Scene Simulation in Three Dimensions
Jerry Tessendorf, Arete Associates

Posters for Session II B: ANALYSIS AND APPLICATIONS

Improving Automated Satellite–Derived Cloud Analysis Through Workstation Applications
Peter J. Broll, Thomas J. Kopp and Thomas J. Neu, Air Force Global Weather Central

Mitigation of the Effects of Cloud Parallax on Target Detection in Imagery Observed from Space
William A. Shaffer and Russell B. Rhodes, Jr., Naval Research Laboratory

Thin Cirrus Cloud Detection: A Preliminary Study
M. Paz Ramos–Johnson and R. Gary Rasmussen, The Analytic Sciences Corporation;
presented by **Glenn J. Higgins**, The Analytic Sciences Corporation

Utility and Uncertainty of P–EARL in Predicting Volcanish Ash Impacts on Commercial Aircraft
Peter Versteegen, Science Applications International Corporation; Mike Dunn, CALSPAN;
Jim Drake, RDA; Anne Vopatek, Defense Nuclear Agency

Remote Sensing of Cloud Thickness and Base from Multispectral Cloud Imager Data
Ronald G. Isaacs, Alberto Bianco, Gary Gustafson and Charles Sarkisian, Atmospheric and Environmental Research, Incorporated

Stochastic Transport Effects on Cloud Retrieval Prepared for CIDOS–93
R. Nelson Byrne and Gordon Eggum, Science Applications International Corporation

Posters for Session III: SYSTEMS AND SENSORS

The Mobile Profiler System: Replacing Balloon–Borne Meteorological Systems
Mary Ann Seagraves and Robert McPeek, U.S. Army Research Laboratory

Cloud Effects on Laminar–Flow Aircraft Performance
Richard E. Davis and Dal V. Maddalon, NASA Langley Research Center

A New Lidar Method Utilizing Elastic and Raman Scattering for the Measurement of Backscatter Ratio and Extinction Profiles
Thomas D. Wilkerson, Utah State University; Hans Moosmüller, University of Nevada

High Altitude Cloud Measurements with an Airborne Lidar at KMR
Dan J. Rusk and Lynn Rose, Aeromet, Incorporated

3–14 μm Nonscanning Spectra of the Minor Uncle Dust Cloud
David K. Lynch, The Aerospace Corporation

Remote Measurements of Cloud Optical Properties with a Robust High Spectral Resolution Lidar
Edwin W. Eloranta and P.K. Piironen, University of Wisconsin–Madison

Posters for Session IV: DATABASES

A Rapid Access Climatology of CFLOS (Cloud Free Line–Of–Sight) at Altitude
Albert R. Boehm, Hughes STX

Characteristics of Archived Cloud Databases in Cloud Climatologies
James H. Willand, Hughes STX

Cloud Information Reference Library Archive
Donald D. Grantham, Geophysics Directorate, Phillips Laboratory; **Paul Try** and **John Burgeson**, Science and Technology Corporation

Climatological and Historical Analysis of Cloud for Environmental Simulations (CHANCES)
Donald L. Reinke, Thomas H. Vonder Haar, Kenneth E. Eis, John M. Forsythe and D. Neil Allen, *STC*–METSAT

New Bi–Spectral Method for Detection of Cloud Liquid Water Over Land
Thomas H. Vonder Haar, Andrew S. Jones, Cynthia L. Combs and Kenneth E. Eis, *STC*–METSAT

APPENDIX B

E^2DIS REQUIREMENTS QUESTIONNAIRE

E²DIS Project
Modeling & Simulation (M & S)
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Administrative Information

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

A. **Administrative Information**

1. Simulation or Model Title: ______________________________
____

2. General Description of the Simulation or Model's Purpose:
(Alternatively, attach a one or two-page existing description)
____
____
____
____
____
____

3. Technical Expert for the Above Simulation or Model

a. Rank/Title, Name, Service: ______________________________
b. Organization Title and Mailing Address:
____
____
____
____
____

c. Phone Numbers
(1) Office: DSN ____ - ________
Commercial ( ) ____ - ________
(2) Fax: DSN ____ - ________
Commercial ( ) ____ - ________

d. E-mail Address: ______________________________

4. Service / Organization having Primary Responsibility for the Simulation or Model: (Circle One)

a. Army b. Navy c. Marine Corps d. Air Force e. Other (Explain) ________

5. Organizational Location(s) of the Simulation or Model: ______________________________
____
____

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[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

B. **Technical Information**

1. **Critical Factors.**

a. What are the most critical factors, or issues, regarding the atmosphere and near-space environment that have to be considered for your simulation or model?

____
____
____
____
____

b. Where are these critical factors documented? (e.g., identify applicable Mission Needs Statement, Statement of Need, Operational Requirement Document, etc.) ______________________________
____
____

2. **Status** of the Simulation or Modeling Effort (Circle One & Fill-in the appropriate Blank(s))

a. "Operational" today; frequency of use is: _____times per day ____ times per week ____ per month
b. Not "operational" today, but will be "operational" by FY-97
c. None of the above (Explain status: ______________________________)

3. **Application** of the Simulation or Modeling Effort

a. Use in Distributed Interactive Simulation (DIS) (Circle One)

(1) Used in DIS today
(2) Not used in DIS today, but planned for DIS use by FY-97
(3) Not used in DIS today, and no plan to use in DIS before FY-97
(4) None of the Above (Explain: ______________________________)

b. This Simulation or Model is used for the following types of simulations:

(Circle All that Apply. Underline the Predominant Use.)

(1) Constructive -- Typically, classroom-setting simulations of large-scale (e.g., theater-wide) military activities.
(2) Virtual -- Forces, platforms, weapon systems and sensors modeled in simulators and fighting on synthetic battlefields depicted by these simulators.
(3) Live Play -- Simulations using real-world forces and equipment in the field.

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[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

3. **Application** of the Simulation or Model [Continued from Page 2]

c. Simulation or Model's Functional Use
(Circle All that Apply. Underline the One Predominant Category)

(1) Education & Training
(2) Research & Development (includes Design & Engineering)
(3) Test & Evaluation (includes both DT&E and OT&E)
(4) Analysis
(5) Production & Logistics
(6) Military Operations (includes Mission Planning and Mission Rehearsal)

d. This Simulation or Model is Primarily Used for which Hierarchical Category(ies)?
(Circle All that Apply. Underline the One Predominant Category)

(1) Campaign Level	(Echelon Above Corps)
(2) Mission Level	(Corps/Division)
(3) Many-on-Many to Few-on-Few Level	(Combined Arms Task Force)
(4) One-on-One Level	(Weapons System)
(5) Engineering Level	(Weapon Subsystem Characteristics)

(6) None of the Above (Explain: ______________________________)

e. Types of Applications Supported: (Circle as Many as Apply. Underline the Predominant One)

(1) Sensor Acquisition of Targets
(2) Mobility of Platforms/Forces
(3) Decision Aids for Command & Control Authority
(4) Other (Explain): ______________________________
____

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[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

3. **Application** of the Simulation or Model [Continued from Page 3]

f. Identify Missions, Forces, Platforms, Weapon Systems, Communications Systems, Sensors & Targets Being Simulated or Modeled: (Attach additional pages, if necessary)

(1) Missions: ______________________________

(2) Forces: ______________________________

(3) Platforms: ______________________________

(4) Weapons Systems: ______________________________

(5) Communications Systems: ______________________________

(6) Sensors:
(a) Active: ______________________________
(b) Passive: ______________________________
(7) Targets: ______________________________

g. List the most authoritative reference document(s) for the Simulation or Model.

____

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[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

4. Simulation or Model's **Domains**

a. **Horizontal Surface** Domain (Circle All that Apply & Underline the Predominant One)

(1) Global (All Landmasses and All Oceans/Seas)
(2) Global Land (All Landmasses, including Adjacent Waters)
(3) Global Ocean (All Ocean Areas, including Adjacent Coastlines)
(4) Regional Land (Specific Land Regions, including Adjacent Waters. e.g., western U.S. Provide a List of the Regions)
(5) Regional Ocean (Specific Ocean Regions, including Adjacent Coastlines. e.g., eastern North Pacific. Provide a List of the Regions)
(6) Littoral (Typically, Regional Land Areas within 650 n.mi. of coastline and Regional Ocean Areas as far seaward as required. Provide a List.)
(7) Local Land (Very Specific Land Areas, including Adjacent Waters. e.g., Fort Irwin, CA. Provide a List)
(8) Local Ocean (Very Specific Ocean Areas, including Adjacent Coastlines. e.g., Southern California OPAREA. Provide a List)
(9) Other (Explain: ______________________________)

b. **Vertical** Domain (Circle All that Apply & Underline the Predominant One; Indicate the Required, Specific Ranges where Requested)

(1) Land Surface
(2) Land Sub-surface Required Range: Depths of ________ km to ________ km
(3) Ocean Surface
(4) Ocean Sub-surface Required Range: Depths of ________ km to ________ km
(5) Atmosphere
   (a) Near-Earth (Surface to 1 km altitude) Required, specific altitude range is: ________ km to ________ km
   (b) Atmosphere (1 km to 300 km altitude) Required, specific altitude range is: ________ km to ________ km
(6) Near-Space (300 km to 70,000 km altitude) Required, specific altitude range is: ________ km to ________ km
(7) Other (Explain: ______________________________)

c. **Time** Domain (Fill-in the Blank and Circle the Appropriate Units of Measure)

(1) The time period that is typically being simulated is:
   ____________ minutes hours days weeks months

(2) The maximum time period that can be simulated is:
   ____________ minutes hours days weeks months

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[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

5. Simulation or Model's **Current Requirements** -- Requirements that have to be satisfied **Today**

a. **Grid**

(1) What type grid does the simulation or model typically use today? ______________________
____

(2) What type map projection does the simulation or model typically use today? ____________

(3) What other grid(s) and projection(s) can the simulation or model use? __________
____

b. Today, this Simulation or Model includes the following **types** of **environmental data and effects**:
(Circle All that Apply, and Complete the Appropriate Attachments)

(1) Atmospheric Data and Effects -- Use Attachment 1
(Surface to 300 km altitude)

(2) Near-Space Data and Effects -- Use Attachment 2
(300 km to 70,000 km altitude)

(3) Other Data and Effects (Identify any other types of environmental data and environmental effects that are required for model runs; e.g., terrain or ocean parameters, features, processes and effects)

____
____
____

c. **Other** Technical Requirements. For each environmental data type and effect that you cite in Attachments 1 and 2, please complete Attachment 3 which describes the following technical requirements:

(1) Fidelity Requirements
(2) Scalability Requirements
(3) Compatibility Requirements
(4) Accessibility Requirements
(5) VV & A Requirements
(6) Currency Requirements

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[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

6. Simulation or Model's **Future Requirements** -- Requirements that will have to be satisfied when an upgrade to the Simulation or Model is implemented sometime in the **Future**

a. Will this Simulation or Model be upgraded by FY-97? (Circle one)

(1) Yes (If Yes, proceed to the next question, 6. b.)
(2) No (If No, proceed to question 6. c.)

b. Briefly, explain the reason(s) for this upgrade. ______________________________

____
____

(1) **Changes resulting from the upgrade.**

(a) List those "current requirements" for environmental data and effects, identified in your responses to 5. a., b. & c. above, that will change as a result of the upgrade; and, briefly describe how these requirements will change quantitatively?

____
____
____
____
____

(b) Why are you changing your requirements for environmental data and effects?

____
____

(2) **New requirements.**

(a) List any new environmental data and effects required as a result of the planned upgrade:

____
____
____
____

(b) Why are you requiring new environmental data and effects?

____
____

Technical Information

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

6. Simulation or Model's **Future Requirements** -- Requirements that will have to be satisfied when an upgrade to the Simulation or Model is implemented sometime in the **Future**

[Continued from Page 7]

c. **Potential Value**. If there are no plans for an upgrade, would an upgrade be considered if environmental data and resulting environmental effects could be reliably provided? (Circle one and Fill-in the Blank)

(1) Yes, for the following reason(s): ____________________
____

(2) No, for the following reason(s): ____________________
____

7. **Briefing**. Would a briefing on atmospheric and near-space parameters, features, processes and effects be of interest to you for your simulation efforts? (Circle one) Yes No

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Attachment 1: Atmospheric Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

A. Simulation or Model Title: ______________________________ (Fill-in the Blank)

B. Vertical Domain: **Atmosphere** (Including the Near-Earth Atmosphere; i.e., Surface to 300 km altitude)

C. **Requirements** for **Atmospheric Data**: (Check All that Apply in the appropriate column, and Indicate the Simulation or Model's Source(s) for each Data Type)

Atmospheric Data Type	Simulation or Model Currently Uses This Data Type (Place an "X" where Applicable and Indicate Source(s) of Data)	Fidelity Requirements for this Data Type (Fill-in the Blanks only if Column 2 is "X'd")	Simulation or Model has the Potential to Use this Data Type (Place an "X" where Applicable)
1. Aerosols a. Cloud b. Haze c. Blowing Dust d. Volcanic Dust e. Smog	a. ___ b. ___ c. ___ d. ___ e. ___	• Horizontal Grid Spacing: ________ m. • Vertical Grid Spacing: ________ m. • Time Resolution: ________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ________	a. ___ b. ___ c. ___ d. ___ e. ___
2. Atmospheric Electricity a. Lightning b. Local Electric Field Potential	a. ___ b. ___	• Horizontal Grid Spacing: ________ m. • Vertical Grid Spacing: ________ m. • Time Resolution: ________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ________	a. ___ b. ___
3. Clouds a. % Sky Coverage b. Liquid Water c. Particle Size d. Bases / Tops e. Types (1) High (2) Medium (3) Low (4) Other (Specify)	a. ___ b. ___ c. ___ d. ___ e. (1) ___ (2) ___ (3) ___ (4) ___	• Horizontal Grid Spacing: ________ m. • Vertical Grid Spacing: ________ m. • Time Resolution: ________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ________	a. ___ b. ___ c. ___ d. ___ e. (1) ___ (2) ___ (3) ___ (4) ___

Attachment 1: Atmospheric Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

C. **Requirements** for **Atmospheric Data**: (Check All that Apply in the appropriate column, and Indicate the Simulation or Model's Source(s) for each Data Type)

[Continued from Page 1-1]

Atmospheric Data Type	Simulation or Model Currently Uses This Data Type (Place an "X" where Applicable and Indicate Source(s) of Data)	Fidelity Requirements for this Data Type (Fill-in the Blanks only if Column 2 is "X'd")	Simulation or Model has the Potential to Use this Data Type (Place an "X" where Applicable)
4. Dew Point	___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ________	___
5. Fog	___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ________	___
6. Humidity a. Absolute b. Relative	a. ___ b. ___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ________	a. ___ b. ___
7. Mixing Ratio	___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ________	___

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[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

C. **Requirements** for **Atmospheric Data**: (Check All that Apply in the appropriate column, and Indicate the Simulation or Model's Source(s) for each Data Type)

[Continued from Page 1-2]

Atmospheric Data Type	Simulation or Model Currently Uses This Data Type (Place an "X" where Applicable and Indicate Source(s) of Data)	Fidelity Requirements for this Data Type (Fill-in the Blanks only if Column 2 is "X'd")	Simulation or Model has the Potential to Use this Data Type (Place an "X" where Applicable)
8. Precipitation a. Rate b. Type (1) Rain (2) Freezing Rain (3) Graupel (4) Hail (5) Sleet (6) Snow	a. ___ b. (1) ___ (2) ___ (3) ___ (4) ___ (5) ___ (6) ___	• Horizontal Grid Spacing: ___________ m. • Vertical Grid Spacing: ___________ m. • Time Resolution: ___________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ________	a. ___ b. (1) ___ (2) ___ (3) ___ (4) ___ (5) ___ (6) ___
9. Refractivity	___	• Horizontal Grid Spacing: ___________ m. • Vertical Grid Spacing: ___________ m. • Time Resolution: ___________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ________	___
10. Sea Level Pressure	___	• Horizontal Grid Spacing: ___________ m. • Vertical Grid Spacing: ___________ m. • Time Resolution: ___________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ________	___
11. Static Stability	___	• Horizontal Grid Spacing: ___________ m. • Vertical Grid Spacing: ___________ m. • Time Resolution: ___________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ________	___

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[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

C. **Requirements** for **Atmospheric Data**: (Check All that Apply in the appropriate column, and Indicate the Simulation or Model's Source(s) for each Data Type)

[Continued from Page 1-3]

Atmospheric Data Type	Simulation or Model Currently Uses This Data Type (Place an "X" where Applicable and Indicate Source(s) of Data)	Fidelity Requirements for this Data Type (Fill-in the Blanks only if Column 2 is "X'd")	Simulation or Model has the Potential to Use this Data Type (Place an "X" where Applicable)
12. Temperature a. Atmosphere b. Surface -- Land c. Surface -- Ocean	a. ___ b. ___ c. ___	• Horizontal Grid Spacing: ______________ m. • Vertical Grid Spacing: ______________ m. • Time Resolution: ______________ sec. • Units of Measure for Data Type: __________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	a. ___ b. ___ c. ___
13. Trace Gases	___	• Horizontal Grid Spacing: ______________ m. • Vertical Grid Spacing: ______________ m. • Time Resolution: ______________ sec. • Units of Measure for Data Type: __________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	___
14. Transmissivity	___	• Horizontal Grid Spacing: ______________ m. • Vertical Grid Spacing: ______________ m. • Time Resolution: ______________ sec. • Units of Measure for Data Type: __________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	___
15. Visibility a. Horizontal b. Slant Range	a. ___ b. ___	• Horizontal Grid Spacing: ______________ m. • Vertical Grid Spacing: ______________ m. • Time Resolution: ______________ sec. • Units of Measure for Data Type: __________ •• Required Range: Min. = _____ Max. = _____ •• Required Accuracy: ________	a. ___ b. ___

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Attachment 1: Atmospheric Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

C. **Requirements** for **Atmospheric Data**: (Check All that Apply in the appropriate column, and Indicate the Simulation or Model's Source(s) for each Data Type)

[Continued from Page 1-4]

Atmospheric Data Type	Simulation or Model Currently Uses This Data Type (Place an "X" where Applicable and Indicate Source(s) of Data)	Fidelity Requirements for this Data Type (Fill-in the Blanks only if Column 2 is "X'd")	Simulation or Model has the Potential to Use this Data Type (Place an "X" where Applicable)
16. Winds -- General a. Horizontal b. Vertical	a. ___ b. ___	• Horizontal Grid Spacing: ________ m. • Vertical Grid Spacing: ________ m. • Time Resolution: ________ sec. • Units of Measure for Data Type: ______ •• Required Range: Min. = ___ Max. = ___ •• Required Accuracy: _____	a. ___ b. ___
17. Winds -- Specific Features a. Fronts b. Gust Fronts c. Hurricanes / Typhoons d. Thunderstorms e. Tornados / Waterspouts f. Turbulence g. Wind Shear	a. ___ b. ___ c. ___ d.___ e. ___ f. ___ g. ___	• Horizontal Grid Spacing: ________ m. • Vertical Grid Spacing: ________ m. • Time Resolution: ________ sec. • Units of Measure for Data Type: ______ •• Required Range: Min. = ___ Max. = ___ •• Required Accuracy: _____	a. ___ b. ___ c. ___ d. ___ e. ___ f. ___ g. ___
18. Radiative Features a. Sky Brightness b. Predetermined Natural Illunination Sources (e.g., particle emissitivity) c. Local Albedo (from e.g., soil, snow cover) d. Cloud Radiance	a. ___ b. ___ c. ___ d. ___	• Horizontal Grid Spacing: ________ m. • Vertical Grid Spacing: ________ m. • Time Resolution: ________ sec. • Units of Measure for Data Type: ______ •• Required Range: Min. = ___ Max. = ___ •• Required Accuracy: _____	a. ___ b. ___ c. ___ d. ___

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[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

C. **Requirements** for **Atmospheric Data**: (Check All that Apply in the appropriate column, and Indicate the Simulation or Model's Source(s) for each Data Type)

[Continued from Page 1-5]

Atmospheric Data Type	Simulation or Model Currently Uses This Data Type (Place an "X" where Applicable and Indicate Source(s) of Data)	Fidelity Requirements for this Data Type (Fill-in the Blanks only if Column 2 is "X'd")	Simulation or Model has the Potential to Use this Data Type (Place an "X" where Applicable)
19. Smoke a. Naturally caused b. Human-generated	a. ___ b. ___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ________	a. ___ b. ___
20. Chaff Dispersion	___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ________	___
21. Combat-generated Dust -- Development and Dispersion	___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ________	___
22. Contrail Formation & Dispersion	___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ________	___

Attachment 1: Atmospheric Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

C. **Requirements for Atmospheric Data:** (Check All that Apply in the appropriate column, and Indicate the Simulation or Model's Source(s) for each Data Type)

[Continued from Page 1-6]

Atmospheric Data Type	Simulation or Model Currently Uses This Data Type (Place an "X" where Applicable and Indicate Source(s) of Data)	Fidelity Requirements for this Data Type (Fill-in the Blanks only if Column 2 is "X'd")	Simulation or Model has the Potential to Use this Data Type (Place an "X" where Applicable)
23. Dispersal of a. Biological Agents b. Chemical Agents c. Flares d. Exhaust Plumes from Terrain Vehicles e. Industrial Smoke Plumes	a. ___ b. ___ c. ___ d. ___ e. ___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ________	a. ___ b. ___ c. ___ d. ___ e. ___
24. Non-Nuclear Munitions Effects a. Explosive Shock-Induced Water Droplet Clouds b. Fireball Temperature	a. ___ b. ___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ________	a. ___ b. ___
25. Nuclear Weapons Detonation Effects a. Enhanced Radiance b. Dispersal of X-rays & nuclear particles c. Movement of Shock Waves d. Winds e. Elevated Temperatures	a. ___ b. ___ c. ___ d. ___ e. ___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ________	a. ___ b. ___ c. ___ d. ___ e. ___

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[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

C. **Requirements** for **Atmospheric Data**: (Check All that Apply in the appropriate column, and Indicate the Simulation or Model's Source(s) for each Data Type)

[Continued from Page 1-7]

Atmospheric Data Type	Simulation or Model Currently Uses This Data Type (Place an "X" where Applicable and Indicate Source(s) of Data)	Fidelity Requirements for this Data Type (Fill-in the Blanks only if Column 2 is "X'd")	Simulation or Model has the Potential to Use this Data Type (Place an "X" where Applicable)
26. Ship Exhaust Tracks (i.e., Dispersal of stack exhaust; ship wakes are not included here, since they are an ocean-embedded process)	___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: __________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ________	___

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[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

D. **Requirements** for **Atmospheric Effects**: (Circle All that Apply, and Fill-in the Appropriate Blanks)

1. <u>Sensor</u> Systems

a. Name of Sensor System:		
b. Energy Type (Specify frequency, wavelength bands or other standard units of measure)	(1) Acoustic ____ (2) Electromagnetic Radiation ____ (3) Particle Radiation ____ (4) Other: (Specify Type & Frequency Band) ____ ____	(1) Acoustic ____ (2) Electromagnetic Radiation ____ (3) Particle Radiation ____ (4) Other: (Specify Type & Frequency Band) ____ ____
c. Type of Sensor	(1) Active (2) Passive	(1) Active (2) Passive
d. Environmental Effects Required	(1) Absorption (2) Ducting (3) Emission (4) Reflection (5) Refraction (6) Scattering (7) Transmission (8) Other: (Specify) ____	(1) Absorption (2) Ducting (3) Emission (4) Reflection (5) Refraction (6) Scattering (7) Transmission (8) Other: (Specify) ____
e. What Line-of-Sight sensor-target geometries are required?	(1) Nadir / Near-nadir (2) Limb / Near-limb (3) Zenith / Near-zenith (4) Other: (Provide azimuth & bearings from sensor) ____	(1) Nadir / Near-nadir (2) Limb / Near-limb (3) Zenith / Near-zenith (4) Other: (Provide azimuth & bearings from sensor) ____
f. Altitude requirements for sensor and target:	(1) Sensor altitude range is: ____ km to ____ km. (2) Target altitude range is: ____ km to ____ km.	(1) Sensor altitude range is: ____ km to ____ km. (2) Target altitude range is: ____ km to ____ km.
g. General state of the environment required:	(1) Quiescent conditions (a) Day (b) Night (c) Terminator (2) Disturbed conditions (a) Aurorially-Disturbed (b) Nuclear-Disturbed (c) Other (Specify): ____ ____	(1) Quiescent conditions (a) Day (b) Night (c) Terminator (2) Disturbed conditions (a) Aurorially-Disturbed (b) Nuclear-Disturbed (c) Other (Specify): ____ ____

Attachment 1: Atmospheric Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

D. **Requirements for Atmospheric Effects:** (Circle All that Apply, and Fill-in the Appropriate Blanks)

[Continued from Page 1-9]

2. Communications Systems

a. Name of Communications System:		
b. Energy Type (Specify frequency, wavelength bands or other standard units of measure)	(1) Acoustic ____ (2) Electromagnetic Radiation ____ (3) Other: (Specify Type & Frequency Band) ____ ____	(1) Acoustic ____ (2) Electromagnetic Radiation ____ (3) Other: (Specify Type & Frequency Band) ____ ____
c. Environmental Effects Required	(1) Absorption (5) Refraction (2) Ducting (6) Scattering (3) Emission (7) Transmission (4) Reflection (8) Other: (Specify) ____	(1) Absorption (5) Refraction (2) Ducting (6) Scattering (3) Emission (7) Transmission (4) Reflection (8) Other: (Specify) ____
d. What type of transmitter - receiver geometries are required?	(1) Line-of-Sight (2) Over-the-Horizon (a) Upper limit of altitude for energy path is: ____ km. (b) Horizontal limit for energy path is: ____ km. (3) Other: (Describe) ____	(1) Line-of-Sight (2) Over-the-Horizon (a) Upper limit of altitude for energy path is: ____ km. (b) Horizontal limit for energy path is: ____ km. (3) Other: (Describe) ____
e. Altitude requirements for transmitter and receiver:	(1) Transmitter altitude range is: ____ km to ____ km. (2) Receiver altitude range is: ____ km to ____ km.	(1) Transmitter altitude range is: ____ km to ____ km. (2) Receiver altitude range is: ____ km to ____ km.
f. General state of the environment required:	(1) Quiescent conditions (a) Day (b) Night (c) Terminator (2) Disturbed conditions (a) Aurorially-Disturbed (b) Nuclear-Disturbed (c) Other (Specify): ____ ____	(1) Quiescent conditions (a) Day (b) Night (c) Terminator (2) Disturbed conditions (a) Aurorially-Disturbed (b) Nuclear-Disturbed (c) Other (Specify): ____ ____

Attachment 1: Atmospheric Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

D. **Requirements** for **Atmospheric Effects**: (Circle All that Apply, and Fill-in the Appropriate Blanks)

[Continued from Page 1-10]

3. Weapon Systems

a. Name of Weapon System:		
b. Required atmospheric effect(s) on the performance of the weapon system (e.g., Deflection of Projectiles/Ordnance Ballistic Trajectories due to Wind):	Provide List:	Provide List:

4. Platforms

a. Name of Platform:		
b. Required atmospheric effect(s) on the performance of the platform (e.g., ice accretion on aircraft, ships, terrain vehicles):	Provide List:	Provide List:

5. Forces

a. Type / Name of Force:		
b. Required atmospheric effect(s) on the performance of the force (e.g., temperature effects on work-load performance / combat efficiency):	Provide List:	Provide List:

6. Other

a. Type / Name of Object:		
b. Required atmospheric effect(s) on the performance of the object:	Provide List:	Provide List:

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Attachment 2: Near - Space Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

A. Simulation or Model Title: ______________________________ (Fill-in the Blank)

B. Vertical Domain: Near - Space (300 km to 70,000 km altitude)

C. **Requirements** for **Near - Space Data**: (Check All that Apply in the appropriate column, and Indicate the Simulation or Model's Source(s) for each Data Type)

Near - Space Data Type	Simulation or Model Currently Uses This Data Type (Place an "X" where Applicable and Indicate Source(s) of Data)	Fidelity Requirements for this Data Type (Fill-in the Blanks only if Column 2 is "X'd")	Simulation or Model has the Potential to Use this Data Type (Place an "X" where Applicable)
1. Auroral Particle Precipitation (i.e., Energy Flux)	___	• Horizontal Grid Spacing: ________ m. • Vertical Grid Spacing: ________ m. • Time Resolution: ________ sec. • Units of Measure for Data Type: ______ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ______	___
2. Cosmic Rays	___	• Horizontal Grid Spacing: ________ m. • Vertical Grid Spacing: ________ m. • Time Resolution: ________ sec. • Units of Measure for Data Type: ______ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ______	___
3. Diffuse Zodiacal Emission a. Infra-red b. Visible	a. ___ b. ___	• Horizontal Grid Spacing: ________ m. • Vertical Grid Spacing: ________ m. • Time Resolution: ________ sec. • Units of Measure for Data Type: ______ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ______	a. ___ b. ___
4. Geomagnetic Field a. Strength b. Indices	a. ___ b. ___	• Horizontal Grid Spacing: ________ m. • Vertical Grid Spacing: ________ m. • Time Resolution: ________ sec. • Units of Measure for Data Type: ______ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ______	a. ___ b. ___

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Attachment 2: Near - Space Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

C. **Requirements for Near - Space Data**: (Check All that Apply in the appropriate column, and Indicate the Simulation or Model's Source(s) for each Data Type)

[Continued from Page 2-1]

Near - Space Data Type	Simulation or Model Currently Uses This Data Type (Place an "X" where Applicable and Indicate Source(s) of Data)	Fidelity Requirements for this Data Type (Fill-in the Blanks only if Column 2 is "X'd")	Simulation or Model has the Potential to Use this Data Type (Place an "X" where Applicable)
5. Interplanetary Medium a. Interplanetary Magnetic Field (1) Strength (2) Orientation b. Solar Wind (1) Velocity (2) Density (3) Temperature c. Magnetopause Standoff Distance	a. ___ (1) ___ (2) ___ b. ___ (1) ___ (2) ___ (3) ___ c. ___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ________	a. ___ (1) ___ (2) ___ b. ___ (1) ___ (2) ___ (3) ___ c. ___
6. Low Energy Plasma Environment a. Ions (1) Composition (2) Number Density (3) Avg Velocity (4) Temperature (5) Flux b. Electrons (1) Number Density (2) Vertical Profiles (3) Total Electron Content (4) Avg Velocity (5) Temperature (6) Flux	a. ___ (1) ___ (2) ___ (3) ___ (4) ___ (5) ___ b. ___ (1) ___ (2) ___ (3) ___ (4) ___ (5) ___ (6) ___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ________	a. ___ (1) ___ (2) ___ (3) ___ (4) ___ (5) ___ b. ___ (1) ___ (2) ___ (3) ___ (4) ___ (5) ___ (6) ___

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Attachment 2: Near - Space Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

C. **Requirements for Near - Space Data**: (Check All that Apply in the appropriate column, and Indicate the Simulation or Model's Source(s) for each Data Type)

[Continued from Page 2-2]

Near - Space Data Type	Simulation or Model Currently Uses This Data Type (Place an "X" where Applicable and Indicate Source(s) of Data)	Fidelity Requirements for this Data Type (Fill-in the Blanks only if Column 2 is "X'd")	Simulation or Model has the Potential to Use this Data Type (Place an "X" where Applicable)
7. Lunar Parameters a. Lunar Brightness b. Lunar Position	a. ___ b. ___	• Horizontal Grid Spacing: ______ m. • Vertical Grid Spacing: ______ m. • Time Resolution: ______ sec. • Units of Measure for Data Type: ______ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ______	a. ___ b. ___
8. Meteoroids & Debris a. Mass b. Diameter c. Density d. Flux e. Impact Flux Size Distribution	a. ___ b. ___ c. ___ d. ___ e. ___	• Horizontal Grid Spacing: ______ m. • Vertical Grid Spacing: ______ m. • Time Resolution: ______ sec. • Units of Measure for Data Type: ______ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ______	a. ___ b. ___ c. ___ d. ___ e. ___
9. Neutral Environment a. Composition b. Density c. Temperature d. Winds	a. ___ b. ___ c. ___ d. ___	• Horizontal Grid Spacing: ______ m. • Vertical Grid Spacing: ______ m. • Time Resolution: ______ sec. • Units of Measure for Data Type: ______ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ______	a. ___ b. ___ c. ___ d. ___
10. Radio Background Noise	___	• Horizontal Grid Spacing: ______ m. • Vertical Grid Spacing: ______ m. • Time Resolution: ______ sec. • Units of Measure for Data Type: ______ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ______	___

Attachment 2: Near - Space Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

C. **Requirements** for **Near - Space Data**: (Check All that Apply in the appropriate column, and Indicate the Simulation or Model's Source(s) for each Data Type)

[Continued from Page 2-3]

Near - Space Data Type	Simulation or Model Currently Uses This Data Type (Place an "X" where Applicable and Indicate Source(s) of Data)	Fidelity Requirements for this Data Type (Fill-in the Blanks only if Column 2 is "X'd")	Simulation or Model has the Potential to Use this Data Type (Place an "X" where Applicable)
11. Solar Parameters a. Solar Position b. Solar Radiative Flux c. Sunspot Activity d. Solar Index	a. ___ b. ___ c. ___ d. ___	• Horizontal Grid Spacing: __________ m. • Vertical Grid Spacing: __________ m. • Time Resolution: __________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: _______	a. ___ b. ___ c. ___ d. ___
12. Star & Planetary Positions	___	• Horizontal Grid Spacing: __________ m. • Vertical Grid Spacing: __________ m. • Time Resolution: __________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: _______	___
13. Energetic Particles a. Particle Type b. Energy c. Flux d. Spatial & Temporal Distribution	a. ___ b. ___ c. ___ d. ___	• Horizontal Grid Spacing: __________ m. • Vertical Grid Spacing: __________ m. • Time Resolution: __________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: _______	a. ___ b. ___ c. ___ d. ___
14. Geomagnetic Storms a. Magnetosphere b. Aurora c. Radiation Belts d. Spatial & Temporal Distribution	a. ___ b. ___ c. ___ d. ___	• Horizontal Grid Spacing: __________ m. • Vertical Grid Spacing: __________ m. • Time Resolution: __________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: _______	a. ___ b. ___ c. ___ d. ___

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[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

C. **Requirements** for **Near - Space Data**: (Check All that Apply in the appropriate column, and Indicate the Simulation or Model's Source(s) for each Data Type)

[Continued from Page 2-4]

Near - Space Data Type	Simulation or Model Currently Uses This Data Type (Place an "X" where Applicable and Indicate Source(s) of Data)	Fidelity Requirements for this Data Type (Fill-in the Blanks only if Column 2 is "X'd")	Simulation or Model has the Potential to Use this Data Type (Place an "X" where Applicable)
15. Gravity Waves	___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ________	___
16. Noctilucent Clouds	___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ________	___
17. Polar Cap Absorption	___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ________	___
18. Sporadic E	___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: ________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ________	___

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[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

C. **Requirements** for **Near - Space Data**: (Check All that Apply in the appropriate column, and Indicate the Simulation or Model's Source(s) for each Data Type)

[Continued from Page 2-5]

Near - Space Data Type	Simulation or Model Currently Uses This Data Type (Place an "X" where Applicable and Indicate Source(s) of Data)	Fidelity Requirements for this Data Type (Fill-in the Blanks only if Column 2 is "X'd")	Simulation or Model has the Potential to Use this Data Type (Place an "X" where Applicable)
19. Sudden Ionospheric Storms	__	• Horizontal Grid Spacing: ________ m. • Vertical Grid Spacing: ________ m. • Time Resolution: ________ sec. • Units of Measure for Data Type: ______ •• Required Range: Min. = ___ Max. = ___ •• Required Accuracy: _____	__
20. Dispersal of Flares	__	• Horizontal Grid Spacing: ________ m. • Vertical Grid Spacing: ________ m. • Time Resolution: ________ sec. • Units of Measure for Data Type: ______ •• Required Range: Min. = ___ Max. = ___ •• Required Accuracy: _____	__
21. Formation & Dispersal of Rocket Exhaust	__	• Horizontal Grid Spacing: ________ m. • Vertical Grid Spacing: ________ m. • Time Resolution: ________ sec. • Units of Measure for Data Type: ______ •• Required Range: Min. = ___ Max. = ___ •• Required Accuracy: _____	__
22. Munitions Effects (Non-nuclear)	__	• Horizontal Grid Spacing: ________ m. • Vertical Grid Spacing: ________ m. • Time Resolution: ________ sec. • Units of Measure for Data Type: ______ •• Required Range: Min. = ___ Max. = ___ •• Required Accuracy: _____	__

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[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

C. **Requirements for Near - Space Data**: (Check All that Apply in the appropriate column, and Indicate the Simulation or Model's Source(s) for each Data Type)

[Continued from Page 2-6]

Near - Space Data Type	Simulation or Model Currently Uses This Data Type (Place an "X" where Applicable and Indicate Source(s) of Data)	Fidelity Requirements for this Data Type (Fill-in the Blanks only if Column 2 is "X'd")	Simulation or Model has the Potential to Use this Data Type (Place an "X" where Applicable)
23. Nuclear Weapons Detonation Effects a. Elevated Temperatures b. Enhanced Radiance c. Dispersal of X-rays and nuclear particles d. Movement of Shock Wave e. Nuclear Heave f. Winds	a. ___ b. ___ c. ___ d. ___ e. ___ f. ___	• Horizontal Grid Spacing: ____________ m. • Vertical Grid Spacing: ____________ m. • Time Resolution: ____________ sec. • Units of Measure for Data Type: __________ •• Required Range: Min. = ____ Max. = ____ •• Required Accuracy: ________	a. ___ b. ___ c. ___ d. ___ e. ___ f. ___

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Attachment 2: Near - Space Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

D. **Requirements for Near - Space Effects:** (Circle All that Apply, and Fill-in the Appropriate Blanks)

1. Sensor Systems

a. Name of Sensor System:		
b. Energy Type (Specify frequency, wavelength bands or other standard units of measure)	(1) Acoustic ____ (2) Electromagnetic Radiation ____ (3) Particle Radiation ____ (4) Other: (Specify Type & Frequency Band) ____ ____	(1) Acoustic ____ (2) Electromagnetic Radiation ____ (3) Particle Radiation ____ (4) Other: (Specify Type & Frequency Band) ____ ____
c. Type of Sensor	(1) Active (2) Passive	(1) Active (2) Passive
d. Environmental Effects Required	(1) Absorption (2) Ducting (3) Emission (4) Reflection (5) Refraction (6) Scattering (7) Transmission (8) Other: (Specify) ____	(1) Absorption (2) Ducting (3) Emission (4) Reflection (5) Refraction (6) Scattering (7) Transmission (8) Other: (Specify) ____
e. What Line-of-Sight sensor-target geometries are required?	(1) Nadir / Near-nadir (2) Limb / Near-limb (3) Zenith / Near-zenith (4) Other: (Provide azimuth & bearings from sensor) ____	(1) Nadir / Near-nadir (2) Limb / Near-limb (3) Zenith / Near-zenith (4) Other: (Provide azimuth & bearings from sensor) ____
f. Altitude requirements for sensor and target:	(1) Sensor altitude range is: ____ km to ____ km. (2) Target altitude range is: ____ km to ____ km.	(1) Sensor altitude range is: ____ km to ____ km. (2) Target altitude range is: ____ km to ____ km.
g. General state of the environment required:	(1) Quiescent conditions (a) Day (b) Night (c) Terminator (2) Disturbed conditions (a) Aurorially-Disturbed (b) Nuclear-Disturbed (c) Other (Specify): ____ ____	(1) Quiescent conditions (a) Day (b) Night (c) Terminator (2) Disturbed conditions (a) Aurorially-Disturbed (b) Nuclear-Disturbed (c) Other (Specify): ____ ____

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Attachment 2: Near - Space Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

D. **Requirements** for **Near - Space Effects**: (Circle All that Apply, and Fill-in the Appropriate Blanks)

[Continued from Page 2-8]

2. Communications Systems

a. Name of Communications System:		
b. Energy Type (Specify frequency, wavelength bands or other standard units of measure)	(1) Acoustic ____ (2) Electromagnetic Radiation ____ (3) Other: (Specify Type & Frequency Band) ____ ____	(1) Acoustic ____ (2) Electromagnetic Radiation ____ (3) Other: (Specify Type & Frequency Band) ____ ____
c. Environmental Effects Required	(1) Absorption (2) Ducting (3) Emission (4) Reflection (5) Refraction (6) Scattering (7) Transmission (8) Other: (Specify) ____	(1) Absorption (2) Ducting (3) Emission (4) Reflection (5) Refraction (6) Scattering (7) Transmission (8) Other: (Specify) ____
d. What type of transmitter - receiver geometries are required?	(1) Line-of-Sight (2) Over-the-Horizon (a) Upper limit of altitude for energy path is: ____ km. (b) Horizontal limit for energy path is: ____ km. (3) Other: (Describe) ____	(1) Line-of-Sight (2) Over-the-Horizon (a) Upper limit of altitude for energy path is: ____ km. (b) Horizontal limit for energy path is: ____ km. (3) Other: (Describe) ____
e. Altitude requirements for transmitter and receiver:	(1) Transmitter altitude range is: ____ km to ____ km. (2) Receiver altitude range is: ____ km to ____ km.	(1) Transmitter altitude range is: ____ km to ____ km. (2) Receiver altitude range is: ____ km to ____ km.
f. General state of the environment required:	(1) Quiescent conditions (a) Day (b) Night (c) Terminator (2) Disturbed conditions (a) Aurorially-Disturbed (b) Nuclear-Disturbed (c) Other (Specify): ____ ____	(1) Quiescent conditions (a) Day (b) Night (c) Terminator (2) Disturbed conditions (a) Aurorially-Disturbed (b) Nuclear-Disturbed (c) Other (Specify): ____ ____

Attachment 2: Near - Space Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

D. **Requirements for Near - Space Effects**: (Circle All that Apply, and Fill-in the Appropriate Blanks)

[Continued from Page 2-9]

3. Weapon Systems

a. Name of Weapon System:		
b. Required near - space effect(s) on the performance of the weapon system:	Provide List:	Provide List:

4. Platforms

a. Name of Platform:		
b. Required near-space effect(s) on the performance of the platform (e.g., drag effects on satellites):	Provide List:	Provide List:

Attachment 2: Near - Space Data and Effects

[Complete all items. Use "N/A" if not applicable, or a "?" if unknown.]

D. **Requirements** for **Near - Space Effects**: (Circle All that Apply, and Fill-in the Appropriate Blanks)

[Continued from Page 2-10]

5. Forces

a. Type / Name of Force:		
b. Required near-space effect(s) on the performance of the force (e.g., zero gravity effects on work-load performance / combat efficiency):	Provide List:	Provide List:

6. Other

a. Type / Name of Object:		
b. Required near-space effect(s) on the performance of the object:	Provide List:	Provide List:

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Attachment 3: Other Requirements

[Complete all items. Use "N/A" if not applicable, or a "?" unknown.]

A. Simulation or Model Title: ______________________________ (Fill-in the Blank)

B. Type(s) of Environmental Data / Effects:

(Circle below all the enviromental data types, identified in the responses to Attachments 1 & 2, that have the same fidelity requirements. Grouping is encouraged to minimize the number of Attachment 3's to be completed. Duplicate this attachment as necessary to characterize all grouped data types / effects.)

1. **Atmospheric** Data / Effects -- Attachment 1: C. 1., 2., 3., 4., 5., 6., 7., 8., 9., 10., 11., 12., 13., 14., 15., 16., 17., 18., 19., 20., 21., 22., 23., 24., 25., 26.
D. 1., 2., 3., 4., 5., 6.

2. **Near - Space** Data / Effects -- Attachment 2: C. 1., 2., 3., 4., 5., 6., 7., 8., 9., 10., 11., 12., 13., 14., 15., 16., 17., 18., 19., 20., 21., 22., 23.
D. 1., 2., 3., 4., 5., 6.

C. **Other Requirements**:

1. Scalability Requirements

a. Do the Simulation or Model's spatial grid and time interval have scaling requirements from the baseline fidelity requirements identified in Attachments 1 and 2 ?
(Circle the Appropriate Answer) Yes No

b. If No, proceed to the next question (2. Compatibility Requirements).

If Yes,
(1) Briefly, explain what grid and time interval scaling is possible: ______________
____
____
(2) Identify any scaling requirements for each environmental data type: ______________
____

Attachment 3: Other Requirements

[Complete all items. Use "N/A" if not applicable, or a "?" unknown.]

C. **Other Requirements**:

[Continued from Page 3-1]

2. Compatibility Requirements

a. Software

(1) Operating System. What operating system software is used to run this Simulation or Model?

____

(2) Programming Languages. What programming languages are used ?

____

(3) Database Management System. What database management system is used ?

____

(4) Near-term Changes. Will any of these three types of software requirements change by FY-97 ? (Circle the Appropriate Answer) Yes No

(a) If Yes, please identify the specific changes: ______________________

____

____

____

(b) If No, proceed to the next question.

b. Hardware

(1) What host hardware system is currently used to run the Simulation or Model? ____________

____

(2) Is the host hardware system transportable?
(Circle the Appropiate Answer) Yes No

(3) What type(s) of data media can the system accept?
(Circle All that Apply)

(a) 9-track Tape
(b) Floppy Disk
(c) CD-ROM
(d) VLDS
(e) 8mm Cartridge
(f) WORM (Specify size)
(g) Floptical Disk
(h) Optical Tape
(i) Video Disk
(j) Other: (Specify) ____________________

Attachment 3: Other Requirements

[Complete all items. Use "N/A" if not applicable, or a "?" unknown.]

C. **Other Requirements**:

[Continued from Page 3-2]

3. Accessibility Requirements

a. Security. What is the maximum information security level of the environmental data authorized for use by the Simulation or Model? (Circle the Appropriate Answer)

(1) Unclassified
(2) Confidential
(3) Secret
(4) Top Secret
(5) Other -- Explain in unclassified terms: ____________________

b. Connectivity. What methods of external communications are authorized for use to input data? (Circle as Many as Apply)

(1) None
(2) Unclassified telephone (with modem) dial-up line.
(3) Encrypted telephone (with modem) dial-up line.
(4) Other -- Explain briefly: ____________________

4. VV&A Requirements

a. Verification. Do the atmospheric and near - space databases, currently being used by this Simulation or Model, have to be "verified" ?

(Circle One) Yes No

(1) If Yes, to what level of detail do you require? ____________________

b. Validation. Do the atmospheric and near - space databases , currently being used by this Simulation or Model, have to be "validated" ?

(Circle One) Yes No

(1) If Yes, to what level of detail do you require? ____________________

Attachment 3: Other Requirements

[Complete all items. Use "N/A" if not applicable, or a "?" unknown.]

C. **Other Requirements**:

4. VV&A Requirements

[Continued from Page 3-3]

c. Accreditation. Do the atmospheric and near - space databases, currently being used by this Simulation or Model, have to be "accredited" ?

(Circle One) Yes No

(1) If Yes, to what level of detail do you require? ______________________________
____
____

5. Currency Requirements

a. Do the atmospheric and near - space databases used by this Simulation or Model have to be based on, or derived from, reasonably current real - world data? (Circle One)

(1) Yes. Briefly explain: ______________________________
____
____

(2) No. There is no specific currency requirement.

APPENDIX C

QUESTIONNAIRE DISTRIBUTION LETTERS

Army
Air Force
Navy

DEPARTMENT OF THE ARMY
HEADQUARTERS UNITED STATES ARMY TRAINING AND DOCTRINE COMMAND
FORT MONROE, VIRGINIA 23651-5000

REPLY TO
ATTENTION OF

ATAN-SM 31 MAY 1994

MEMORANDUM FOR SEE DISTRIBUTION

SUBJECT: Environmental Effects for Distributed Interactive Simulation (E2DIS) Project Requirements Survey

1. Request you assist the multi-service E2 DIS Project in conducting a survey of your organization. This survey is being conducted in cooperation with the Army Modeling and Simulation Management Office in support of the Defense Modeling and Simulation Management Office. Your assistance is requested to accomplish the following:

a. Identify all <u>major</u> modeling and simulation (M&S) efforts that are <u>routinely used</u> within your organization, and those major M&S efforts currently <u>in development</u>.

b. Specify a single point of contact, who is technically versed, for each M&S effort.

c. Provide the above information to Science and Technology Corporation by 30 June 1994. Forward your response either via mail or facsimile to the following:

Science and Technology Corporation
ATTN: Tom Piwowar
409 Third Street, S.W.
Suite 203
Washington, D.C. 20024

Facsimile: (202) 488-5364
Phone: (202) 863-0012

2. E2DIS Project background information and a summary of the Survey Task is provided at Enclosure 1. Information on how the survey will be conducted and a copy of the Requirements Questionnaire is at Enclosure 2.

ATAN-SM
SUBJECT: Environmental Effects for Distributed Interactive Simulation (E2DIS) Project Requirements Survey

3. Distribution of the results of this survey effort, in the form of the products listed in Enclosure 1 will be made to all survey respondents once the survey data is compiled and analyzed.

2 Encls

William J. Macpherson Jr.
WILLIAM J. MACPHERSON, JR.
Colonel, GS
Assistant Deputy Chief of
Staff for Analysis

DISTRIBUTION:
DEPUTY CHIEF OF STAFF FOR LOGISTICS, ATTN: DALO-PLZ-A, RM 2C567, 500 ARMY PENTAGON, WASHINGTON, DC 20310
DEPUTY CHIEF, ARMY RESERVE, ATTN: DAAR-ZB, RM 3E390, 2400 ARMY PENTAGON, WASHINGTON, DC 20310-2400
OFFICE OF THE CHIEF OF ENGINEERS, ATTN: DAEN-ZCM, RM 1E668, 2600 ARMY PENTAGON, WASHINGTON, DC 20310-2600
CHIEF, TRAINING DIVISION, NATIONAL GUARD BUREAU, ATTN: NGB-AROT, 111 SOUTH GEORGE MASON DRIVE, ARLINGTON, VA 22204-1382
U.S. ARMY SPACE COMMAND, ATTN: MOSC-OPI, 1670 NORTH NEWPORT ROAD, COLORADO SPRINGS, CO 80916-2749
DEP CINC, HQ USAREUR & SEVENTH ARMY, APO AE 09014
CDR, USA FORSCOM, ATTN: FCJ3-TSD, FORT MCPHERSON, GA 30330-6000
CDR, USA FORSCOM, ATTN: FCJ8-PBO, FORT MCPHERSON, GA 30330-6000
EIGHTH U.S. ARMY, ATTN: EACJ-ED, APO AP 96204
CDR, USA PACIFIC, ATTN: APRM-MC, FORT SHAFFTER, HI 96858-5100
CDR, USA SOUTH, ATTN: SOCS, APO MIAMI, FL 34004-5000
CDR, USA SPECIAL OPERATIONS COMMAND, ATTN: AOFI- CPC, FORT BRAGG, NC 28307-5200
CDR, USA SPACE AND STRATEGIC DEFENSE COMMAND, ATTN: CSSD-CR, P.O.BOX 1500, HUNTSVILLE, AB 35807
CDR, USAAMC, ATTN: AMCRD, 5001 EISENHOWER AVENUE, ALEXANDRIA, VA 22333-0001
CDR, USA OPERATIONAL TEST AND EVALUATION COMMAND, ATTN: CSTE-ZA, 4501 FORD AVENUE, ALEXANDRIA, VA 22302-1458
(CONT)

DISTRIBUTION: (CONT)

TECHNICAL DIRECTOR, AMC USATECOM, ATTN: AMSTE-TD, ABERDEEN PROVING GROUND, MD 21005-5055

CDR, USASTRICOM, ATTN: AMSTI-CG, 12350 RESEARCH PARKWAY, ORLANDO, FL 32826

CDR, USA ARMAMENT, MUNITIONS AND CHEMICAL COMMAND, ROCK ISLAND, IL, 61299-6000

CDR, USA AVIATION AND TROOP COMMAND, 4300 GOODFELLOW BOULEVARD, ST. LOUIS, MO 63120-1798

CDR, USA COMMUNICATIONS-ELECTRONICS COMMAND, FORT MONMOUTH, NJ 07703-5000

CDR, USA MISSILE COMMAND, REDSTONE ARSENAL, AL 35898-5000

CDR, USA TANK-AUTOMOTIVE COMMAND, WARREN, MI 48397-5000

USA TEST AND EVALUATION COMMAND, ABERDEEN PROVING GROUND, MD 21005-5055

USA RESEARCH LABORATORY, ADELPHI, MD 20783-1145

USA RESEARCH LABORATORY, ADVANCED COMPUTATIONAL AND INFORMATION SCIENCE DIRECTORATE, SIMULATION TECHNOLOGY DIVISION, ATTN: AMSRL-CI-S, ABERDEEN PROVING GROUND, MD 21005-5067

CDR, USA ARMAMENT RESEARCH, DEVELOPMENT AND ENGINEERING CENTER, PICATINNY ARSENAL, NJ 07806-5000

CDR, USA BELVOIR RESEARCH, DEVELOPMENT AND ENGINEERING CENTER, 10101 GRIDLEY ROAD , SUITE 104, FORT BELVOIR, VA 22060-5818

CDR, USA NATICK RESEARCH, DEVELOPMENT AND ENGINEERING CENTER, NATICK, MA 01760-5000

CDR, USA CORPS OF ENGINEERS, ATTN: CERD-ZA, 20 MASSACHUSETTS AVENUE, NW, WASHINGTON, DC 20314-1000

CDR, USA INFORMATIONS SYSTEMS COMMAND, ATTN: ASQB-OSA, FORT HUACHUCA, AZ 85613-5000

CDR, USA LOGISTICS EVALUATION AGENCY, ATTN: LOEA-PL, NEW CUMBERLAND, PA 17070-5007

CDR, BALLISTIC MISSILE DEFENSE SYSTEMS COMMAND, PO BOX 150, HUNTSVILLE, AL 35807-3801

CDR, USA TEST AND EXPERIMENTATION COMMAND, FORT HOOD, TX 76544-5065

CDR, TEST AND EXPERIMENTATION COMMAND EXPERIMENTATION CENTER, FORT ORD, CA 93941-7000

(CONT)

DISTRIBUTION: (CONT)
DIR USA TOPOGRAPHIC ENGINEERING CENTER, ATTN: CDTEC-ZA, FORT BELVOIR, VA 22060-5546
DIR, USA RESEARCH INSTITUTE FOR THE BEHAVIORAL AND SOCIAL SCIENCES, ATTN: PERI-ZA, 5001 EISENHOWER AVENUE, ALEXANDRIA, VA 22333
DIR, USA RESEARCH OFFICE, P.O. BOX 12211, RESEARCH TRIANGLE PARK, NC 27709-2211
DIR, COMMUNICATIONS-ELECTRONICS RESEARCH, DEVELOPMENT AND ENGINEERING CENTER, FORT MONMOUTH, NJ 07703
DIR, RESEARCH, DEVELOPMENT AND ENGINEERING CENTER, USA MISSILE COMMAND, REDSTONE ARSENAL, AL 35898-5000
DIR USA TANK-AUTOMOTIVE RESEARCH, DEVELOPMENT AND ENGINEERING CENTER, WARREN, MI 48397-5000
DIR, USA AVIATION RESEARCH, DEVELOPMENT AND ENGINEERING CENTER, 4300 GOODFELLOW BOULEVARD, ST. LOUIS, MO 63120-1798
DIR, USA EDGEWOOD RESEARCH, DEVELOPMENT AND ENGINEERING CENTER, ABERDEEN PROVING GROUND, MD 21010-5423
DIR, USA MISSILE SPACE AND INTELLIGENCE CENTER, REDSTONE ARSENAL, AL 35898-5500
DIR, USA COLD REGIONS RESEARCH AND ENGINEERING LABORATORY, 72 LYME ROAD, HANOVER, NH 03755-1290
DIR, WATERWAYS EXPERIMENT STATION, 3909 HALLS FERRY RD, VICKSBURG, MS 39180
DIR, USA CONCEPTS ANALYSIS AGENCY, ATTN: CSCA-ZA, 8120 WOODMONT AVENUE, BETHESDA, MD 20814-2797
DIR, USA MATERIEL SYSTEMS ANALYSIS ACTIVITY, ATTN: AMXSY-D, ABERDEEN PROVING GROUND, MD 21005-5071
DEPUTY COMMANDING GENERAL FOR COMBINED ARMS, ATTN: ATDC-CA, FORT LEAVENWORTH, KS 66027-5000
CDR, USATRADOC, ATTN: ATCD-B, FORT MONROE, VA 23651-5000
CDR, USACAC, ATTN: ATZL-NSC, FORT LEAVENWORTH, KS 66027
CDR, USACAC, ATTN: ATZL-CT, FORT LEAVENWORTH, KS 66027
CDR, USACAC, ATTN: ATZL-CDC, FORT LEAVENWORTH, KS 66027
CDR, USA TRAINING SUPPORT CENTER, ATTN: ATIC-DMD, FORT EUSTIS, VA 236604-5389
CDR, USACASCOM, FORT LEE, VA 23801-6000
CDR, USACASCOM, ATTN: ATCL-B, FORT LEE, VA 23801-6000
CDR, USACASCOM, ATTN: ATCL-L, FORT LEE, VA 23801-6000
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CDR, USA SIGNAL CENTER, ATTN: ATZH-BL, FORT GORDON, GA 30905-5299
TSM, CATT, ATTN: ATZK-SM, 1109C 6TH AVENUE, FT KNOX, KY 40121-5000
DIR, USATRAC, ATTN: ATRC, FORT LEAVENWORTH, KS 66027-5200
DIR, USA TRAC, ATTN: ATRC-L, FORT LEE, VA 23801-6140
DIR, USA TRAC, ATTN: ATRC-W, WHITE SANDS MISSILE RANGE, WHITE SANDS, NEW MEXICO 88002
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DIR, USA TRAC, ATTN: ATRC-TD, FORT LEAVENWORTH, KS 66027
DIR, USA TRAC, ATTN: ATRC-RDM, P.O. BOX 8692, NAVAL POST GRADUATE SCHOOL, MONTEREY, CA 93943-0692
CDR, USA INFANTRY CENTER AND FORT BENNING, FORT BENNING, GA 31905-5000
CDR, USAADACENFB, 1733 PLEASONTON RD, FORT BLISS, TX 79916-6816
CDR, US ARMY TRANSPORTATION CENTER AND FORT EUSTIS, FORT EUSTIS, VA 23604-5000
CDR, US ARMY SIGNAL CENTER AND FORT GORDON, FORT GORDON, GA 30905-5000
CDR, US ARMY TRAINING CENTER AND FORT JACKSON, FORT JACKSON, SC 29207-5000
CDR, US ARMY ARMOR CENTER AND FORT KNOX, FORT KNOX, KY 40121-5000
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CDR, US ARMY INTELLIGENCE CENTER AND FORT HUACHUCA, FORT HUACHUCA, AZ 85613-6000
CDR, US ARMY ENGINEER CENTER AND FORT LEONARD WOOD, FORT LEONARD WOOD, MO 65473-5000
CDR, USAARMC, ATTN: ATZK-MW, FORT KNOX, KY 40121-5000
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CDR, US ARMY ORDNANCE CENTER AND SCHOOL, ABERDEEN PROVING GROUND, MD 21005-5201
COMDT, ARMY WAR COLLEGE, ATTN: AWC-AW, CARLISLE BARRACKS, PA 17013
COMDT, US ARMY COMMAND AND GENERAL STAFF COLLEGE, FORT LEAVENWORTH, KS 66027-6900
COMDT, USA LOGISTICS MANAGEMENT COLLEGE, FORT LEE, VA 23801
SUPERINTENDENT, US MILITARY ACADEMY, WEST POINT, NY 10996-5000
COMDT, ARMED FORCES STAFF COLLEGE, NORFOLK, VA 23511-6097

CF:
DEPUTY UNDER SECRETARY OF THE ARMY (OPERATIONS RESEARCH), ATTN: SAUS-OR, RM 2E660, 102 ARMY PENTAGON, WASHINGTON, DC 20310-0102
DEPUTY CHIEF OF STAFF FOR OPERATIONS AND PLANS, ATTN: DAMO-ZA, RM 3E634, 400 ARMY PENTAGON, WASHINGTON DC 20310-0400
DEPUTY CHIEF OF STAFF FOR OPERATIONS AND PLANS, ATTN: DAMO-ZD, RM 3A538, 400 ARMY PENTAGON, WASHINGTON, DC 20310-0400
ASSISTANT SECRETARY OF THE ARMY FOR RESEARCH, DEVELOPMENT, AND ACQUISITION, ATTN: SARD-ZT, RM 3E374, 103 ARMY PENTAGON, WASHINGTON, DC 20310-0103

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ASSISTANT SECRETARY OF THE ARMY FOR RESEARCH, DEVELOPMENT AND ACQUISITION, ATTN: SARD-ZD, RM 2E673, 103 ARMY PENTAGON, WASHINGTON, DC 20310-0103
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OFFICE OF THE DEPUTY CHIEF OF STAFF FOR INTELLIGENCE, ATTN: DAMI-PII, RM 2E464, 1000 ARMY PENTAGON, WASHINGTON, DC 20310-1000
DIR, INFORMATION SYSTEMS FOR COMMAND, CONTROL, COMMUNICATIONS, AND COMPUTERS, ATTN: SAIS-ADM, RM 1C670, 107 ARMY PENTAGON, WASHINGTON, DC 20310-0107
LOGISTICS MANAGEMENT INSTITUTE, 6400 GOLDSBORO RD, BETHESDA, MD 20817-5887
CDR, USA FOREIGN SCIENCE AND TECHNOLOGY CENTER , CHARLOTTESVILLE, VA 22901-5396
DIR, ARMY MODEL AND SIMULATION MANAGEMENT OFFICE, ATTN: SFUS-MIS, SUITE 808, CRYSTAL SQUARE II, 1725 JEFFERSON DAVIS HIGHWAY, ARLINGTON, VA 22202
CDR, USATRADOC, DEPUTY CHIEF OF STAFF FOR COMBAT DEVELOPMENTS, ATTN: ATCD-ZA, FORT MONROE, VA 23651-5000
CDR, USATRADOC, DEPUTY CHIEF OF STAFF FOR TRAINING, ATTN: ATTG-ZA, FORT MONROE, VA 23651-5000
DIR, LAM TF, ATTN: DACS-LM, FORT MONROE, VA 23651

Environmental Effects for Distributed Interactive Simulation

(E2DIS)

Project and Survey Task Summary

In 1993, the DoD Modeling and Simulation Working Group recommended via the Executive Council for Modeling and Simulation and the Under Secretary of Defense (Acquisition and Technology) approved the multi-service E2DIS Project for funding. Consistent with the Defense initiative emphasizing the creation of synthetic environments, one of the project's primary goals is to develop an overall methodology for incorporating appropriate fidelity, physics-based representations of the environment and environmental effects using DIS protocols. The E2DIS Project development methodology includes a series of demonstrations that incorporate the effects of atmospheric phenomena, such as clouds, temperature, wind and visibility, on military systems.

A Program Development Plan (PDP) describes how the E2DIS Project Team will achieve the project's goals in terms of seven task areas. It describes in detail how each of these tasks will be conducted. As cited in the PDP, Task 5, the Survey of Requirements and Capabilities, consists of two sub-tasks:

Sub-task 1: Determine the major modeling and simulation environmental requirements (current and anticipated) for Army, Navy, Air Force, and Marine Corps' weapon systems operating in the atmosphere and near-space.

Sub-task 2: Identify existing environmental models and data bases available to support simulation activities and assess their applicability and fidelity.

The results of these two sub-tasks will be published in three documents:

- The *Environment Simulation Requirements Document*
- The *Environment Model and Database Catalog*
- The *Analysis and Required New Capabilities Document*

Enclosure 1

Environmental Effects for Distributed Interactive Simulation

(E2DIS)

Requirements Survey Guidelines

Survey Team. To accomplish the work associated with the Survey Task, the E2DIS Project has selected Science and Technology Corporation (STC) to interface with the Services and other Government agencies. STC Survey Team members include: Dr. Paul Try, John Burgeson, Ken Eis, Carl Chesley, Jerry Johnson, Paul Cooper, and Tom Piwowar.

Survey Procedure.

1. Your organization forwards a list of major M&S efforts and technical points of contacts (POCs) for each effort to STC.

2. Within five (5) working days after receipt of the list, and STC Survey Team member contacts your technical POC to schedule an interview (either on-site or via telephone) to complete the Requirements Questionnaire. A copy of the questionnaire is attached; copies should be made available to each technical POC.

3. Prior to the interview, technical POCs should review the questionnaire and enter as many responses as possible. Approximately one and one-half hours should be allotted for the STC Survey Team to conduct each Requirements Survey interview.

4. Completed questionnaires should be forwarded immediately to:

Science and Technology Corporation ATTN: Tom Piwowar 409 Third Street, S.W. Suite 203 Washington, D.C. 20024	Facsimile: (202) 488-5364 Phone: (202) 863-0012

Government Point of Contact. The Army representative for the E2DIS Project's Survey Task is :

Dr. Alan Wetmore	Phone: (505) 678-5563
Army Research Laboratory	Facsimile: (505) 678-8366

Dr. Wetmore should be notified on any issues that might arise during the execution of this survey.

Enclosure 2

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE

5 JUL 1994

MEMORANDUM FOR SEE DISTRIBUTION

FROM: HQ USAF/XOW
1490 Air Force Pentagon
Washington DC 20330-1490

SUBJECT: Environmental Effects for Distributed Interactive Simulation (E^2DIS) Project Modeling & Simulation Requirements Questionnaire

One of the E^2DIS project's primary goals is to develop an overall methodology for incorporating appropriate fidelity, physics-based representations of the environment and environmental effects using Distributed Interactive Simulation (DIS) protocols. To help meet these goals, the E^2DIS Project Team has selected Science and Technology Corporation (STC) to survey the Services and other Government agencies.

The attached Requirements Questionnaire is specifically intended to:

a. Determine the major modeling and simulation environmental requirements (current and anticipated) for Army, Navy, Air Force, and Marine Corps weapon systems operating in the atmosphere and near-space.

b. Identify existing environmental models and data bases available to support simulation activities and assess their applicability and fidelity.

Please have your technical POC, i.e., a "modeler" rather than a "user," review the questionnaire and enter as many responses as possible. A member of the STC Survey Team will contact each agency to schedule an interview with the technical POC, either on-site or via telephone, to complete the questionnaire. Plan on 90 minutes for the interview.

Send completed surveys, to arrive by *8 Aug 94*, to:

Science and Technology Corporation
Attn: Tom Piwowar
409 Third Street, S.W.
Suite 203
Washington, D.C. 20024

Facsimile: (202) 488-5364
Phone: (202) 863-0012

If you have any comments or questions, my POC is Maj Mike Remeika, DSN 223-8277 or Commercial (703) 693-8277.

Thomas F. Tascione

THOMAS F. TASCIONE, Colonel, USAF
Deputy Director of Weather
DCS, Plans and Operations

Attachments:
1. Distribution List
2. Requirements Questionnaire

cc:
HQ USAF/XOM
HQ USAF/XOOT
HQ AWS/XT
USAFETAC/SYT

DISTRIBUTION LIST

HQ ACC/DOST (Attn: Maj Mattison)
205 Dodd Blvd Suite 101
Langley AFB VA 23665-2789

HQ ACC/DOT (Attn: Ken Madison)
205 Dodd Blvd Suite 101
Langley AFB VA 23665-2789

HQ AETC/XOR (Mr Pat Bowden)
1 F St Suite 2
Randolph AFB TX 78150

HQ AFMC/XRT (Attn: Mr Larry O'Grady)
Wright Patterson AFB OH 45433

HQ AFOTEC/SAN (Attn: Lt Col W Koozin)
8500 Gibson Blvd SE
Kirtland AFB NM 87117-5558

AFOTEC/TFT
8500 Gibson Blvd SE
Kirtland AFB NM 87117-5558

HQ AFSOC/DOT
100 Bartley St
Hurlburt Fld FL 32544

HQ AFSPACECOM/DRR (Attn: Maj Converse)
150 Vandenberg St Suite 1105
Peterson AFB Co 80914-4170

Air University
CADRE/WG (Attn: Col Collson)
401 Chennault Circle
Maxwell AFB AL 36112-6428

HQ AMC/XOTS (Attn: Maj Stahre)
402 Scott Dr Unit 3A1
Scott AFB IL 62225-5302

ANGRC/DOE (Lt Col Tom Vierzba)
1400 28th Ave N, Bldg 80002
Fargo, ND 58102-1051

Armstrong Laboratory (AL)/HRA (Attn: Col Lynne Carol)
6001 S Power Rd Bldg 558
Mesa, AZ 85206-0904

ASC/RWWW (JMASS) (Attn: Mr Mark Savchitz)
Wright Patterson AFB OH 45433

ASC/YT (Attn: Mr Bill Curtis)
Wright Patterson AFB OH 45433

ASC/YWE (Attn: Mr Brown)
Bldg 14
1865 4th St Suite 11
Wright-Patterson AFB OH 45433-7125

Chief Naval Operations (Attn: CMDR Clager)
2000 Navy Pentagon Rm 4E419
Washington DC 20350-2000

NAWAD (Attn: Mr McCrillis)
NAWAD SA102
Patuxent River MD 20670

58 OG/DOU (Attn: Mr Smith)
4249 Hercules Way
Kirtland AFB NM 87117-5861

58 OG/DOU (Attn: Lt Col E Reed)
4249 Hercules Way
Kirtland AFB NM 87117-5811

4444 OPS (Attn: Maj Charpollios)
752 Durand Rd
Langley AFB VA 23665-2596

Det 1, 4444 OPS (Attn: Lt Col Poe)
7045 N Fighter Country Ave
Luke AFB AZ 85309-1637

HQ PACAF/DOT (Mr Baker)
25 E St Suite 1232
Hickam AFB HI 96853-5426

Phillips Laboratory (Attn: Lt Col Johnson)
Bldg 914/Satellite Assessment Center
Kirtland AFB NM 87117-5670

Space Warfare Center/XR (Attn: Lt Col L Raney)
730 Irwin Avenue
Falcon AFB CO 80912-7300

619 TRSS/IDS (Maj Searcey)
1150 5th St E Suite 2
Randolph AFB TX 78150-4404

29 TSS (Attn: Lt Col Kirkpatrick)
203 West D Ave, Suite 400
Eglin AFB FL 32542-6867

USAF BTS
138 Harlson Street
Hurlburt AFB FL 32544-5231

HQ USAF/TEP (Attn: Maj B Ishihara)
1530 Air Force Pentagon
Washington DC 20330-1530

HQ USAF/XOMW (Attn: Col Peterman)
1480 Air Force Pentagon
Washington DC 20330-1480

HQ USAF/XOMW (Attn: Lt Col D Smith)
1480 Air Force Pentagon
Washington DC 20330-1480

HQ USAF/XOOT (Attn: Lt Col Christian)
1480 Air Force Pentagon
Washington DC 20330-1480

HQ USAFE/DOT
Unit 3050 Box 15
APO AE 09094-5015

Environmental Effects for Distributed Interactive Simulation

(E^2DIS)

Project and Survey Task Summary

In 1993, the DoD Modeling and Simulation Working Group recommended via the Executive Council for Modeling and Simulation and the Under Secretary of Defense (Acquisition and Technology) approved the multi-Service E^2DIS Project for funding. Consistent with the Defense initiative emphasizing the creation of synthetic environments, one of the project's primary goals is to develop an overall methodology for incorporating appropriate fidelity, physics-based representations of the environment and environmental effects using Distributed Interactive Simulation (DIS) protocols. The E^2DIS Project development methodology includes a series of demonstrations that incorporate the effects of atmospheric phenomena, such as clouds, temperature, wind and visibility, on military systems.

A Program Development Plan (PDP) describes how the E^2DIS Project Team will achieve the project's goals in terms of seven task areas. It describes in detail how each of these tasks will be conducted. As cited in the PDP, Task 5, the Survey of Requirements and Capabilities, consists of two sub-tasks:

Sub-task 1: Determine the major modeling and simulation environmental requirements (current and anticipated) for Army, Navy, Air Force and Marine Corps' weapon systems operating in the atmosphere and near-space.

Sub-task 2: Identify existing environmental models and data bases available to support simulation activities and assess their applicability and fidelity.

The results of these two sub-tasks will be published in three documents:

- The *Environment Simulation Requirements Document*
- The *Environment Model and Database Catalog*
- The *Analysis and Required New Capabilities Document*

Attachment 1

Environmental Effects for Distributed Interactive Simulation

(E^2DIS) Project

Requirements Survey Guidelines

Survey Team. To accomplish the work associated with the Survey Task, the E^2DIS Project has selected Science and Technology Corporation (STC) to interface with the Services and other Government agencies. STC Survey Team members include: Dr. Paul Try, John Burgeson, Ken Eis, Carl Chesley, Jerry Johnson, Paul Cooper, and Tom Piwowar.

Survey Procedure.

1. Your organization forwards a list of major M&S efforts and technical points-of-contacts (PoCs) for each effort to STC.
2. Within five (5) working days after receipt of the list, an STC Survey Team member contacts your technical PoC to schedule an interview (either on-site or via telephone) to complete the Requirements Questionnaire. A copy of the questionnaire is attached; copies should be made available to each technical PoC.
3. Prior to the interview, technical PoCs should review the questionnaire and enter as many responses as possible. Approximately one and one-half hours should be allotted for the STC Survey Team to conduct each Requirements Survey interview.
4. <u>Completed questionnaires</u> should be <u>forwarded immediately</u> to:

Science and Technology Corporation
Attn: Tom Piwowar
409 Third Street, S.W.
Suite 203
Washington, D.C. 20024

Facsimile: (202) 488-5364
Phone: (202) 863-0012

Government Point-of-Contact. The Air Force representative and Leader for the E^2DIS Project's Survey Task is:

Mr. Donald Grantham
Phillips Laboratory (Hanscom Air Force Base, MA)

Phone: (617) 377-2982
Facsimile: (617) 377-2984

Mr. Grantham should be notified of any issues that might arise during the execution of this survey.

Attachment 2

TEAM MIKE MEMO

1 August 1994

MEMORANDUM FOR DISTRIBUTION

Subject: Distribution List for the E^{2}DIS Project's Requirements Questionnaire

Encl: (1) E^{2}DIS Project Modeling & Simulation (M&S) **Requirements** Questionnaire

The DMSO funded Environmental Effects for DIS (E^{2}DIS) project has generated a questionnaire (enclosure 1) to survey DoD requirements on M&S and the environment. The organizations listed under distribution have been selected from the Team Mike participants to represent Navy's input in the five DMSO-defined M&S functional areas (T&E, R&D, Analysis, Training, and Logistics). Other ways to categorize the M&S information are constructive, virtual, live play as well as level of fidelity and scalability.

We request that the Team Mike representatives get the survey to the proper person/s (unless you are it) to be completed and returned by August 29th,1994. In return, the respondees will receive a document outlining all services' M&S efforts, needs, and requirements for environmental data (ETC: March 95). In addition, from the "capabilities" survey--not included in this package--the same respondees will receive a document consisting of all the available/applicable environmental databases and models (ETC: March'95). Your input will also help E^{2}DIS develop methodologies and toolboxes for users to incorporate the environment in a DIS domain.

The point of contact for the E^{2}DIS questionnaire is **Tom Piwowar** at the Science and Technology Corp. located at 409 3rd st. SW, Suite 203, Washington, DC 20024. His phone number is (202) 863-0012 and his fax number is (202) 488-5364. Thank you for your cooperation.

Very respectfully;

George Phillips

Subject: Distribution List for the E^2DIS Project's Requirements Questionnaire

Distribution List:
CINCLANTFLT
CINCPACFLT
CINCUSNAVEUR
CNA
COMTRALANT
COMTRAPAC
COMOPTEVFOR
COMSUBDEVRON 12
NAVAIRSYSCOM
NAVAIRWARCEN (DC, WD, AC, AD)
NAVCOMTELCOM
NAVDOCTRINECOM
NAVFACSYSCOM
NAVSEASYSCOM
NAVSPECWARCEN
NAVSTRIKEWARCEN & NAVFITWEPSCOL
NAVSUPSYSCOM
NAVSURFWARCEN (Carderock, Dahlgren, Port Hueneme, Panama City, Indian Head)
NAVUNSEAWARCEN (New London, Newport, Keyport)
NAVWARANALCEN
NAVWARCOL
NAWC-TSD
NCCOSC
NRL (DC only)
OCNR
SPAWARSYSCOM
TACTRAGRULANT
TACTRAGRUPAC